VOICE SWITCHING AND CONTROL SYSTEM

Attachment J-3

PRODUCT SPECIFICATION

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DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

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1.0 INTRODUCTION

1.1 SCOPE

This specification provides a description of the engineering and design requirements of the Voice Switching and Control System (VSCS) for installation in the National Airspace System (NAS). Included in this document are the VSCS requirements for functionality, operational performance, hardware, construction, software, testing, and quality assurance.

The requirements of this VSCS product specification, without addenda, shall be applicable to the current prototype equipment.

The requirements of this VSCS product specification, modified as per Addendum 1, shall be applicable to the four-hundred-thirty position prototype upgrade and all systems delivered to Federal Aviation Administration (FAA) operating facilities.

At the direction of the Government, the requirements of this VSCS product specification, modified as per Addendum 1 and Addendum 2, shall be applicable to the VSCS. When conflicts exist between the paragraphs of Addendum 1 and Addendum 2, the paragraphs of Addendum 2 shall take precedence.

1.1.1 Overview

The VSCS will provide voice communications necessary to implement the Initial Sector Suite System (ISSS) and the Advanced Automation System (AAS) in Area Control Facilities (ACFs) of the 1990s. The VSCS must be flexible enough to satisfy communication system performance criteria for the Air Route Traffic Control Centers (ARTCCs) environment and the evolution to the new AAS in the ACF environments. It must also meet current and future operational and maintenance requirements at a minimal cost per service. Implementation of a VSCS satisfying these criteria will enhance controller productivity.

A major improvement in air traffic control (ATC) capability will occur with the development of the ISSS, which provides new controller positions. A sector suite will consist of an appropriate number (one to five) of common consoles (C/Cs) to meet the individual requirements of the airspace to be controlled. The VSCS will provide display and entry devices (EDs) for voice communications on each of the ISSS common consoles.

The VSCS will be capable of being reconfigured to perform different functions under a changing ATC environment. Therefore, specific displays and connectivities of the VSCS will be under programmable control.

1.1.2 VSCS Description

The VSCS will be a computer-controlled switching system that will provide air traffic controllers with the means to establish all voice circuits necessary for ATC operations in the 1990s. Up to 430 positions (C/Cs) will be served in each ACF. The VSCS will be fully compatible with the AAS and the reconfigurable Sector Suite (S/S) concept.

ATC personnel will use the VSCS as follows:

(a) Air-to-ground (A/G) radio: Controllers will use the VSCS to access and provide proper control of the remote ultra high frequency (UHF)/very high frequency (VHF) A/G transmitters and receivers through which they communicate with pilots. The VSCS will also ensure that incoming A/G communications from pilots are routed to the appropriate control position. Connectivity to the Backup Emergency Communications (BUEC) will be provided to operating positions.

b) Intercom: Through the VSCS, ATC personnel within an ARTCC/ACF will be able to access other control positions or ancillary positions located within that ARTCC/ACF.

(c) Interphone: ATC personnel at an ARTCC/ACF will be able to access positions located within another ATC facility.

(d) External circuits: The VSCS will provide access to Public Switched Telephone Network (PSTN), and Federal Telecommunications System (FTS) and local telephone exchanges via an interface with the Private Automatic Branch Exchange (PABX) in the facility.

In this specification the VSCS is represented by the following functional areas:

(a) Entry/display: This area encompasses the communications control panels and data entry devices at the ATC controller and ancillary positions. Systems control inputs, circuit selection, and commands for connectivity are entered, interpreted, and processed while circuit status and system status indicators are supplied to the users on an interactive operational basis.

(b) Switching: This area encompasses the relationship between the electronic hardware and the operating system (program control). It is the area wherein command connect and related input (I)/output (O) data are resolved to implementation. Connectivity changes and validations in response to reconfiguration are also performed.

(c) Control: This area encompasses the hierarchical relationship of every VSCS component, function, and combinations thereof with respect to program control, including the reception of real-time data acquisition requests, real-time operating status, and real-time quality control. This functional area is defined by built-in algorithms, voice traffic management requirements, and interfaces with other major systems.

This division does not preclude the use of different types of architectures for the VSCS and is used for convenience in describing the VSCS functions.

1.2 DOCUMENT ORGANIZATION

This document is the engineering specification for the VSCS. Contained herein are the requirements for intrafacility (intercom), interfacility (interphone), and A/G radio communications for air traffic control at the ACFs.

1.3 CROSS REFERENCING

Cross references, that is, references to parts within this specification and other documents, shall refer to the stated paragraph and all its subparagraphs.

2.0 APPLICABLE DOCUMENTS

2.1 GENERAL

The following FAA specifications, standards, drawings, and NAS configuration management documents listed in the various categories defined below form a part of this specification and are applicable to the extent described in this document. The correct version of the documents referenced in this specification will be stated in the contract. The standard DOD-STD-2167 as found throughout this Contract shall mean DOD-STD-2167A as tailored in Section C.

2.2 FAA DOCUMENTS

2.2.1 FAA Specifications

Document	Title
FAA-C-1217	Electrical Work, Interior
FAA-G-2100	Electronic Equipment General Requirements
FAA-E-2290C	Control Equipment, Radio Channel
FAA-D-2494/b	Technical Instruction Book Manuscript; Electronic, Electrical, and Mechanical Equipment, Requirements for Preparation of Books
FAA-ER-130-005H-AP	Advanced Automation System, System Level Specification

2.2.2 FAA Standards

Document	Title
FAA-STD-001	Color and Texture of Finishes for Airspace System Equipment
FAA-STD-016	Quality Control System Requirements
FAA-STD-018	Computer Software Quality Program Requirements
FAA-STD-019	Lightning Protection, Grounding, Bonding, and Shielding Requirements for Facilities
FAA-STD-020	Transient Protection, Grounding, Bonding, and Shielding Requirements for Facilities
FAA-STD-021	Configuration Management
FAA-STD-025	Preparation of Interface Control Documents

2.2.3 Other FAA Documents

Document	Title
NAS-IR-61004201	ACF-VSCS
NAS-IR-21014201 (part 2)	VSCS-ACCC(Common Console) ICD
NAS-IR-64024201	VSCS-BUEC IRD
NAS-IR-42009404	VS-PABX IRD
NAS-IR-42014202	VSCS/TCS INTERPHONE IRD
NAS-IR-42004205	VS-REC IRD
NAS-IR-80104201	VSCS-Power IRD
NAS-IR-41024201	VSCS-RCE IRD
VS-I-01	VSCS-TRUNKS ICD
NAS-IR-44010002	TRANSMISSION EQUIPMENT: ANALOG INTERFACE IRD
FAA Order 1600.54	Security of FAA Automatic Data Processing Systems and Facilities
FAA Order 6650.9	Requirements for Area Control Facility (ACF) Under the Floor Cabling
FSD/VSCS-WP-001.6	VSCS Distribution Frame and Radio Interface Intermediate Distribution Frame Top Level Design
CTA-211-V-0208-91	Interaction of the Dual Jack Modules

2.3 MILITARY PUBLICATIONS

2.3.1 Military Specifications

Document	Title
MIL-E-17555	Electronic and Electrical Equipment, Accessories, and Repair Parts, Packaging and Packing of

2.3.2 Military Standards

Document	Title
DOD-STD-2167	Defense System Software Development
MIL-STD-1388-2	DoD Requirements for a Logistics Support Analysis Record
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-275	Printed Wiring for Electronic Equipment
MIL-STD-415	Test Provisions for Electronic Systems and Associated Equipment, Design Criteria for
MIL-STD-454	Standard General Requirements for Electronic Equipment
MIL-STD-461	Electromagnetic Emission and Susceptibility Requirements
MIL-STD-462	Electromagnetic Interferences Characteristics, Measurement of
MIL-STD-470	Maintainability Program for Systems and Equipment
MIL-STD-471	Maintainability Demonstration
MIL-STD-721	Definitions of Effectiveness Terms for Reliability, Maintainability, Human Factors, and Safety
MIL-STD-785	Reliability Program for Systems and Equipment Development and Products
MIL-STD-882	System Safety Program Requirements
MIL-STD-1280	Keyboard Arrangements
MIL-STD-1472	Human Engineering Design Criteria for Military Systems, Equipment, and Facilities
MIL-STD-1521	Technical Reviews and Audits for Systems, Equipment, and Computer Software
DOD-STD-100	Engineering Drawing Practices

2.4 AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) STANDARDS

Document	Title
ANSI/IEEE C37	Definition, Specification, and Analysis of Manual, Automatic, and Station Control and Data Acquisition
ANSI/IPC-T-50	Terms and Definitions for Interconnecting and Packaging Electronic Circuits
ANSI S3.2 1960	Monosyllabic Word Intelligibility, Method for Measurement of
ANSI X3.28-1966	Procedures for the Use of the Command Control Characters of the American National Standard Code for Information Interchange (ASCII) in Specified Data Communication Links
ANSI X3.66-1979	American National Standard for Advanced Data Communication Control Procedures (ADCCP)

2.5 INDUSTRY STANDARDS

Document	Title
EIA-IS-4	Transmission Loss Plan for a Mu-Law Compatible PBX
EIA/TIA-464A	Private Branch Exchange (PBX) Switching Equipment for Voiceband Application
IEEE-488	IEEE Standard Digital Interface for Programmable Instrumentation
IEEE STD 743-1984	IEEE Standard Methods and Equipment for Measuring the Transmission Characteristics of Analog Voice Frequency Circuits
NEC, NFPA-70	National Electric Code 1990
IEEE STD 823-1989	IEEE Standard Methodologies for Specifying Voicegrade Channel Transmission Parameters and Evaluating Connection Transmission Performance for Speech Telephony

2.6 FEDERAL STANDARDS

Document	Title
29 CFR 1910	OSHA Safety and Health Standard

2.7 DOCUMENT PRECEDENCE

When conflicts exist between the requirements of the contract and this specification, the contract shall take precedence. When conflicts exist between the requirements of this specification and its referenced documents, this specification shall take precedence. When the requirements of the U.S. Government Printing Office Style Manual conflict with the requirements (a) specified herein, or (b) in any other applicable FAA standards, requirements of this specification and other FAA specifications shall apply.

2.8 DOCUMENT SOURCES

Copies of this specification and other applicable FAA specifications, standards, and drawings may be obtained from the Contracting Officer in the Federal Aviation Administration Office issuing the invitation for bids or request for proposals. Requests should fully identify material desired, i.e., specification, standard, amendment, and drawing numbers. Requests should cite the invitation for bids, request for proposals, the contract involved, or other use to be made of the requested material.

Single copies of applicable federal and military specifications, standards, and drawings may be obtained by ordering through the Naval Publications and Forms Center (NPFC), Philadelphia, which is the Department of Defense Single Stock Print (DOD-SSP) and distribution center for unclassified specifications and standards. Documents may be ordered by writing: Naval Publications and Forms Center, Customer Service Department, Code 1052, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120; or calling (215) 697-3321, Monday through Friday, from 8 a.m. to 4:30 p.m. (Eastern time).

Information on obtaining copies of the National Electrical Code may be obtained from the National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.

Information on obtaining copies of the Metric Practice Guide may be obtained from the American National Standards Institute, Incorporated, 1430 Broadway, New York, New York 10018.

3.0 REQUIREMENTS

3.1 GENERAL REQUIREMENTS

The VSCS shall be designed, developed, fabricated, tested, delivered, installed, integrated, cut over, and made fully operational in accordance with this specification and the contract schedule.

3.1.1 Definitions and Formulas

The definitions and related mathematical formulas for terms used herein shall be in accordance with Appendix I, Acronyms, Abbreviations, Definitions, Terms, and Formulas.

3.1.2 Equipment, Software, and Services to be Furnished

All necessary engineering, management, equipment, software, services, documentation, and testing shall be provided in accordance with this specification and the contract schedule.

3.1.3 System Design and Construction Features

The VSCS shall be designed and constructed using proven state-of-the-art, solid-state switching technology and standard components, circuits, software, and interfaces. The system design and construction shall meet the architectural and human factors requirements specified herein and the capacity, modularity, growth, and performance criteria specified in 3.2, System Characteristics.

3.1.3.1 A/G Backup Switch - The VSCS shall provide a separate switch to back up the A/G switching and control functions of the VSCS. The failure of the A/G function even at a single sector in the facility is unacceptable. However, as the facilities are expected to have at least 10% slack positions, the VSCS can mitigate intra VSCS A/G failures of up to 10% of the assigned frequencies, restoring A/G communications to all sectors. Beyond that point, switchover to the A/G backup switch will be required. Thus, in the event of a failure of the A/G primary switch, which causes 10% or more of the assigned frequencies to become nonoperational within a facility, the A/G primary switch shall be disconnected automatically, and the operational A/G backup switch shall assume those functions. The area manager shall have the capability to manually activate and deactivate the A/G backup switch, thus transferring the A/G switching functions to and from the A/G backup switch. Separate paths for voice, control, and power shall be provided. The A/G backup switch shall be fully reconfigurable in accordance with 3.1.5, Reconfiguration Functions.

3.1.3.2 Architecture - The system architecture shall meet the operational, reliability, maintainability, availability (RMA) and performance requirements specified, plus the following three additional constraints:

3.1.3.2.1 Voice and Data Resource Constraints - The VSCS architecture shall have a sufficient number of simultaneous voice paths to carry maximum offered voice traffic and shall not cause blocking due to a lack of voice paths. However, blocking caused by control system and call processing shall not exceed the grade of service and throughput timing requirements of 3.2.

3.1.3.2.2 Adaptability - As the VSCS will function in a frequently changing environment, the system performance shall be maintained at the specified levels even if there are changes in the number and types of terminations, changes in the volume and mix of voice traffic, and changes in configurations (see 3.2). The additions and reductions to the on-line VSCS shall be implemented without disruption to unaffected system elements.

3.1.3.2.3 Failure Impact Limitation - The system architecture shall, by design, limit the impact of the failure of individual components to single functions (e.g., transmit (TX), receive (RX), direct access (DA)) and to single terminations (e.g., ground-to-ground (G/G) trunk, position, radio trunk).

3.1.3.3 Human-engineered VSCS Console Equipment - The VSCS design shall be in accordance with the human/system interface requirements of MIL-STD-1472 as specified in 3.4.

3.1.3.3.1 Reuse of VSCS Console Equipment (VCE) - The interactive display panels and electronics box developed for use in the AAS common console shall also be used in existing controller consoles through adaptive mounting hardware. Any additional hardware required to provide temporary VCE use in the existing console shall meet the requirements of this specification.

3.1.3.4 Parts Policy - The VSCS parts policy shall follow the criteria of MIL-STD-1388-2 with tailoring to meet the higher reliability requirements of the specification.

3.1.4 ATC Communication Functions

3.1.4.1 Radio Communications and Control - The VSCS shall provide radio communications switching and the capacity to select and control radio transmitters, receivers, and transceivers located at either local or remote radio sites from the ATC positions via the radio interfaces.

3.1.4.2 BUEC - The VSCS shall provide connectivity and control between BUEC classmarked positions to the BUEC priority module in accordance with 3.6, Interfaces.

3.1.4.3 G/G Communication - G/G communication shall include all intercom (IC) and interphone (IP) functions and access to external networks via PABX.

3.1.4.3.1 Intercom (IC) - The VSCS shall provide IC connectivity and the capability to permit any position within a facility to establish voice communications to any other position in that facility.

3.1.4.3.2 Interphone (IP) - The VSCS shall provide IP capability for an ATC position to establish and receive calls to or from ATC positions at other ATC facilities. That capability shall include the appropriate connections with positions via the switching systems whose Interface Control Documents (ICDs) and Interface Requirements Documents (IRDs) are listed in 3.6.

3.1.4.3.3 PABX Interface Function - The VSCS shall interface with the PABX being procured by the Federal Aviation Administration (FAA) for access to external networks including PSTN and local telephone exchanges.

3.1.4.4 VSCS Switching Features - Special features provided by the VSCS shall include, but not be limited to: local and remote override (OVR), hold, call forwarding, monitoring, headset (HS)/loudspeaker (LS) transfer, and two types of conferencing: progressive and meet-me conference.

3.1.4.5 RESERVED (See Addendum 1)

3.1.5 Reconfiguration Functions

The VSCS shall provide the capability for reconfiguration of communications connectivity for each operating position. This shall include Direct Access (DA) assignments and indications, radio frequency assignments, and classmarks and functions commensurate with the responsibilities of each operating position. The position displays shall correspond to the new connectivities. Reconfigurations shall be executed in accordance with predetermined maps in response to reconfiguration commands. Execution of reconfiguration shall not, in any way, interrupt or disturb the calls in progress. The details are specified in 3.5, Switching and Control Functions.

3.1.6 Other System Features

3.1.6.1 Timing and Synchronization - The VSCS shall provide an internal time standard for time stamping. It shall also have the capability to synchronize with external networks to support communications (see 3.5.4.4).

3.1.6.2 Power Supply - The VSCS equipment shall draw power from the FAA-supplied power conditioning system (PCS). The VSCS shall operate from commercial AC power in the event of PCS failure. Interface to power sources shall be as described in the VSCS-Power IRD (see 3.6.14).

3.1.6.3 Classmarks - The VSCS shall have a software-controlled classmarking capability to restrict functions and access for all positions and trunk circuits. Classmark requirements are specified in 3.5.4.1, Reconfiguration.

3.1.6.4 Numbering Plan - A comprehensive numbering plan, subject to FAA approval, shall be defined in accordance with the requirements in 3.3.2.2.12, VSCS Numbering Plan, emphasizing simplicity and speed of dialing.

3.1.7 Interface Design Features

The VSCS design shall employ standard internal and external interfaces and protocols. External interfaces shall be as required in 3.6, Interfaces.

3.1.8 Telecommunication Interfaces

The VSCS shall provide telecommunication interfaces as detailed in the following paragraphs.

3.1.8.1 Backbone Microwave System - The VSCS shall interface with the backbone microwave system in accordance with the VSCS-Trunk IRD (see 3.6.8).

3.1.8.2 Leased Transmission Service - For communications to facilities that are not on the backbone microwave system, the VSCS shall interface with circuits leased from common carriers.

3.1.8.3 Telephone Networks - The VSCS shall provide access to external switched telephone networks (PSTN and FTS) through the administrative PABX collocated with VSCS within each facility.

3.1.8.4 Integrated Communications Switching System (ICSS) - The VSCS shall provide connectivity to ICSSs in accordance with the VSCS - Trunks ICD.

3.1.8.5 Tower Communications Switch (TCS) - The VSCS shall provide connectivity in accordance with the VSCS/TCS Interphone IRD.

3.1.8.6 Traffic Management Voice Switch (TMVS) - The VSCS shall provide connectivity to the TMVS located at the Central Flow Control Facility (CFCF) via standard trunks.

3.1.8.7 A/G Communications Network - The connectivities to remote A/G radio control facilities (RCFs) will be provided by standard trunks. The VSCS shall provide access to these facilities via radio interface.

3.1.9 Maintenance Functions

3.1.9.1 Maintenance Staffing Limit - The staffing goal for the VSCS is to maintain each system with one trained person available one shift per day. During the other two shifts, a maintenance person will be on call. The VSCS reliability and maintainability allocations to meet the availability specified in 3.2 shall be within this workforce limitation. Maintenance personnel other than at the site level (e.g., at the FAA Depot) are not counted in this workforce limit.

3.1.9.2 Fault Detection and Isolation - The VSCS shall provide fault detection and isolation including self-diagnostics and the capability to identify a failure; isolate the defective module, circuit, or trunk; automatically configure its function around the problem; and allow the isolated faulty module to be serviced without disrupting ATC operations. All detected faults shall be automatically reported to the maintenance position for testing and correction.

3.1.9.3 Testing - The VSCS shall have the capability to initiate automatic and manual test routines. The VSCS shall monitor the results of automatic test routines from the maintenance position for any system elements identified by the fault isolation mechanism. The VSCS shall minimize the need for specialized test equipment by built-in self-test features.

3.1.9.4 Verification - The VSCS shall have built-in test equipment (BITE) and built-in-test (BIT) software for on-line verification of the system as specified in 3.8, Verification, for the entire system, including position and backroom equipment. Critical parameters shall be measured, recorded, and compared with tolerance limits; a record highlighting out-of-tolerance conditions shall be provided.

3.1.10 Management Functions

3.1.10.1 ATC Operational Training - The VSCS functions and features that support operational training shall include operational monitoring and jack preemption at the supervisory positions.

3.1.10.2 Traffic Data Collection, Reduction, and Analysis - The VSCS shall provide the capability for on-line voice traffic data collection.

3.1.10.3 Security - The VSCS software design shall include security provisions to prevent unauthorized access to the system (See 3.11).

3.1.11 Software Features

All software shall have the following features: user-friendliness, modularity, transportability, reliability, testability, fail-soft/fail-safe, maintainability, and requirement testability. All software shall be well documented. Software shall meet the requirements stated in 3.10, Software.

3.1.11.1 Operating Systems - Commercially available computers within the VSCS environment shall be controlled by commercially available operating systems that are fully supported and maintained. Such operating systems shall be in a stable condition (not under development), in routine operation in an environment external to the contractor, and fully documented. Additionally, these operating systems shall support all peripheral devices in the VSCS design that are offered as accessories to the commercial computers. A commercially available support environment, compatible with the operating systems, shall be available to allow efficient development and maintenance of VSCS software. Such support shall include, but not be limited to, one or more high-level languages, debugging and testing aids, text editors, and documentation aides.

3.1.11.2 Embedded Processors - Embedded processors in the VSCS shall be controlled by fully documented software. Commercially available support equipment and support environments shall be available to allow efficient development and maintenance of embedded VSCS software.

3.1.12 Alternate Standards

Alternate industry standards employed in the areas of transmission parameters, off-the-shelf software development, and physical construction practices may be accepted, subject to FAA approval, when such alternate standards are determined by the FAA to be substantially equivalent to the FAA and Military Standards referenced in this specification.

3.1.13 Commercial Products - Commercial products are preferred, but not mandatory. Commercial products used in the VSCS shall comply with all the functional, performance, physical, electrical, and RMA requirements of this specification. Documentation for commercial products shall include all the information and levels of detail required by this specification, but may be prepared in accordance with commercial standards, subject to FAA approval. Commercial products used in the VSCS may use commercial standards for materials, manufacturing processes and manufacturing practices.

3.2 SYSTEM CHARACTERISTICS

3.2.1 Capacity, Modularity, and Growth

3.2.1.1 Capacity - The VSCS shall be designed to meet the maximum future sizing requirements listed in Table I while supporting the voice traffic loads of Table II.

3.2.1.2 Modularity and Growth - The system hardware, software, firmware, cabling, power supplies, interfacing, and maintenance equipment shall be modular. The system design and construction shall meet the sizing requirements imposed by variations in facility sizes and configurations, frequent changes required during the ACF consolidation phase, system growth, and maintenance requirements. The system shall be capable of growth, in increments as small as one position or trunk at a time.

3.2.2 Performance

The VSCS shall meet the following performance requirements specified below for all operational environments as shown in Table I.

3.2.2.1 Grades of Service and Traffic Loads During Both Peak Busy Hour (PBH) and Peak Busy Minute (PBM) - If a call is not established within the timing requirements specified in Table III, then it is considered blocked. The ratio of calls blocked, when the destination trunks or positions are available, to total number of calls attempted is defined as the grade of service. The VSCS shall provide the grades of service as specified in Table II under the traffic loads of PBH and PBM.

3.2.2.2 Throughput Timing Requirements - The VSCS shall meet the throughput timing requirements specified in Table III and the paragraphs below, subject to the traffic loads, blocking probabilities, and call distribution during the PBH and PBM conditions shown in Table II and Table IIa. All specified response times shall be applicable as "end to end" measurement points with reference to the VSCS external equipment interfaces. Response times shall not include touch entry detection time for transactions originating at a position. They shall not include display device response times for transactions terminating at a position. They shall not include the delays and wait periods associated with operator inputs (e.g., digit dialing). For transactions originating at a trunk or radio interface, the beginning of the throughput timing interval shall be receipt by the switch of the complete information needed to service the transaction. For transactions terminating at a radio or trunk interface, the end of the throughput timing interval shall be initiation of the latest event at that interface that does not depend on the interface behavior or protocol; that is, the latest event having timing totally dependent on VSCS switch performance.

3.2.2.2.1 A/G Push-to-Talk (PTT) Transmit/Release and Indicator Response Time

3.2.2.2.1.1 A/G PTT Transmit Response Time - The response time for this event shall be from the instant that an A/G PTT signal is generated (after the PTT switch makes contact without waiting for debouncing) at the position, to the instant that this signal, or the A/G Voice Channel(s) invoked by this signal, whichever is later, is present at the A/G interface with the VSCS. For 95% of the event completions, this event response time shall not exceed 25 msec. For 99.99% of the event completions, this event response time shall not exceed 70 msec. Delays outside the VSCS are not included.

3.2.2.2.1.2 A/G PTT Indicator Response Time - The response time for this event shall be from the instant that a PTT confirmation signal is present at the radio interface with the VSCS, to the instant that indicator response is activated at the calling position. For 95% of the event completions, this event response time shall not exceed 75 msec. For 99.9% of the event completions, this event response time shall not exceed 200 msec.

3.2.2.2.1.3 System-Generated A/G PTT Transmit Response Time - The response time for this event shall be from the instant that a request for a feature which requires a system-generated A/G PTT is present in the VSCS, to the instant that an A/G PTT signal is present at the A/G interface with the VSCS. For 95% of the event completions, this event response time shall not exceed 75 msec. For 99.99% of the event completions, this event response time shall not exceed 150 msec.

3.2.2.2.1.4 A/G PTT Release Transmit - The response time for this event shall be from the instant that the A/G PTT activation is terminated at the position, to the instant that the A/G PTT signal is no longer present at the A/G interface with the VSCS. For 95% of the event completions, this response time shall not exceed 25 msec. For 99.99% of the event completions, this response time shall not exceed 30 msec. If voice delay exceeds the specified A/G PTT release time, then the actual response time shall not exceed the voice delay + 4 msec for both the 95% and 99.99% event completions.

Table I. Operational Environments

Sizing Parameter	Initial No. Required		Maximum Future Sizing
	Minimum	Maximum	
Positions	50	340	430
Interfacility Trunks (Interphone)	50	450	570
Radio Interfaces	50	300	350
PABX Tielines	12	30	40
BUEC Interfaces	25	100	240

Note: The data under "Minimum" represent a generic Minimum System, but does not preclude zero for any item. The contract schedule defines exact sizing for each site.

Table II. Grades of Service and Average Traffic Loads Per Position During Peak Busy Hour (PBH) and Peak Busy Minute (PBM)

Function	Grade of Service	Holding Time, s**	Erlangs (PBH)	Calls/ Hour During PBH***	Erlangs (PBM)	Calls/Minute During PBM***
PTT (A/G)	Non- blocking	4	0.13	117	0.234	3.5
Radio Squelch Break	Non- blocking	4	0.13	117	0.234	3.5
Main/Standby TX/RX	0.001			4		0.2
IC	0.001	20	0.06	11	0.36	1.1
IP Local Initiation	0.001	20	0.06	11	0.36	1.1
IP Remote Initiation	0.001	20	0.06	11	0.36	1.1
PABX Access Local Initiation	0.001	180	0.03	<1	0.06	0.02
PABX Access Remote Initiation	0.001	180	0.03	<1	0.06	0.02

** Distribution for holding times is exponential.
*** Distribution for arrival rates is Poisson.

Table IIa. PBH and PBM Call Distribution

Function	Call Mode	Percentage of Usage
PTT (A/G) [1]	Controller Generated PTT	100%
IC	non-OVR	15%
	OVR	85%
IP	non-OVR	25%
	OVR	75%

[1] Assume for loading analysis, 20% of the A/G frequencies are cross-coupled.

3.2.2.2.1.5 A/G PTT Release Indicator - The response time for this event shall be from the instant that a PTT confirmation signal is no longer present at the A/G interface with the VSCS, to the instant that indicator response is deactivated at the position. For 95% of the event completions, this event response time shall not exceed 75 msec. For 99.9% of the event completions, this event response time shall not exceed 200 msec.

3.2.2.2.1.6 RESERVED (See Addendum 1)

3.2.2.2.1.7 RESERVED (See Addendum 1)

3.2.2.2.1.8 RESERVED

3.2.2.2.1.9 RESERVED

3.2.2.2.1.10 Frequency Preemption Activation - The response time for this event shall be from the instant the PTT switch is activated by the operator to the instant that PTT causes termination of any transmission in progress on that frequency at any other ATC position. For 95% of the event completions, this event response time shall not exceed 25 msec. For 99.99% of the event completions, this event response time shall not exceed 30 msec.

3.2.2.2.1.11 RESERVED (See Addendum 1)

Table III. Setup/Teardown Throughput Timing Requirements During PBH and PBM

Type of Event	Maximum Response Time, msec* Percent of Event Completions		
	95%	99.9%	99.99%
A/G PTT Transmit	25		70
A/G PTT Indicator	75	200	
System-Generated A/G PTT Transmit	75		150
A/G PTT Release Transmit	25		30
A/G PTT Release Indicator	75	200	
A/G Backup Switch Switchover		250	
M/S TX/RX Transfer	75	150	
M/S TX/RX Transfer Confirmation	75	150	
Remote Receiver Muting (A/G Interface)	75	200	
Remote Receiver Muting Confirmation	75	150	
G/G PTT Transmit	75	100	
G/G PTT Release	75	100	
IC Call Placement	250	350	
IC Call Acceptance	200	300	
IC Circuit Release	250	350	
Voice Delay	60	70	
Position-to-Trunk IP Call Placement	200	300	
Position-to-Trunk IP Call Placement (type 5)	250	450	
Trunk-to-Position IP Call Placement	200	300	
Trunk-to-Position IP Call Placement (type 5)	250	450	
Position-to-Trunk IP Call Acceptance	250	350	
Position-to-Trunk IP Call Acceptance (type 5)	250	450	
Trunk-to-Position IP Call Acceptance	200	300	
Position-to-Trunk IP OVR Call Placement Response Time	250	400	
Trunk-to-Position IP OVR Call Acceptance Response Time	300	400	
IC OVR Call Placement/Acceptance Response Time	250	450	
IP Circuit Release	250	350	
Dial Tone for Indirect Access	250	350	
Display Devices			100
TED Detection			50
Frequency Preemption Activation	25		30

***** Where applicable, response times exclude TED detection time and display device response times.

3.2.2.2.2 A/G Backup Switch Switchover Response Time - The response time for this event shall be from the instant that the switchover procedure is initiated, either under automated or manual control, to the instant that the A/G backup switch is completely operational with the same functionality and configuration as the A/G primary switch. For 99.9% of the event completions, this event response time shall not exceed 250 msec.

3.2.2.2.3 Main/Standby (M/S) TX/RX Transfer and Confirmation Response Time

3.2.2.2.3.1 M/S TX/RX Transfer Response Time - The response time for this event shall be from the instant that the M/S TX/RX transfer signal is generated at a position, to the instant that this transfer signal is present at the A/G interface with the VSCS. For 95% of the event completions, this event response time shall not exceed 75 msec. For 99.9% of the event completions, this event response time shall not exceed 150 msec.

3.2.2.2.3.2 M/S TX/RX Transfer Confirmation Response Time - The response time for this event shall be from the instant that the transfer confirmation signal is present at the A/G interface with the VSCS, to the instant that an indicator response signal is activated at the position that generated the M/S TX/RX selection signal. For 95% of the event completions, this event response time shall not exceed 50 msec. For 99.9% of the event completions, this event response time shall not exceed 150 msec.

3.2.2.2.4 Receiver Muting Response Times

3.2.2.2.4.1 Remote Receiver Muting Response Time - The response time for this event shall be from the instant that the remote receiver muting signal is generated at a position, to the instant that this signal is present at the A/G interface with the VSCS. For 95% of the event completions, this event response time shall not exceed 75 msec. For 99.9% of the event completions, this event response time shall not exceed 200 msec. Remote receiver muting is not used with some existing radio interfaces.

3.2.2.2.4.2 Remote Receiver Muting Confirmation Response Time - The response time for this event shall be from the instant that the muting confirmation signal is present at the A/G interface with the VSCS, to the VSCS, to the instant that an indicator response signal is activated at the position that generated the remote receiver muting signal. For 95% of the event completions, this event response time shall not exceed 75 msec. For 99.9% of the event completions, this event response time shall not exceed 150 msec.

3.2.2.2.4.3 RESERVED (See Addendum 1)

3.2.2.2.4.4 RESERVED (See Addendum 1)

3.**2.2.2.4.5 RESERVED (See Addendum 1**)

3.2.2.2.4.6 RESERVED (See Addendum 1)

3.2.2.2.4.7 RESERVED (See Addendum 1)

3.2.2.2.4.8 RESERVED (See Addendum 1)

3.2.2.2.5 RESERVED (See Addendum 1)

3.2.2.2.5.1 RESERVED (See Addendum 1)

3.2.2.2.5.2 RESERVED (See Addendum 1)

3.2.2.2.6 Ground-to-Ground (G/G) PTT Transmit and Indicator Response Time

3.2.2.2.6.1 G/G PTT Transmit Response Time - The response time for this event shall be from the instant that a G/G PTT signal is generated at the position, to the instant that voice transmission over the established path can begin. For 95% of the event completions, this event response time shall not exceed 75 msec. For 99.9% of the event completions, this event response time shall not exceed 100 msec. Delays outside the VSCS are not included.

3.2.2.2.6.2 G/G PTT Release Response Time - The response time for this event shall be from the instant that the G/G PTT signal is terminated at the position, to the instant that voice transmission ceases from the position. For 95% of the event completions, this event response time shall not exceed 75 msec. For 99.9% of the event completions, this event response time shall not exceed 100 msec. Delays outside the VSCS are not included.

3.2.2.2.7 Intercom (IC) Setup Response Time

3.2.2.2.7.1 IC Call Placement Response Time - The response time for this event, whether it be a two-party IC call or an IC addition to a progressive conference call, shall be from the instant that the address is generated at the position, to the instant that the called position is notified by appropriate VSCS internal signaling. For 95% of the event completions, this event response time shall not exceed 250 msec. For 99.9% of the event completions, this event response time shall not exceed 350 msec.

3.2.2.2.7.2 IC Call Acceptance Response Time - The response time for this event, whether it be a two-party IC call or an IC addition to a progressive conference call, shall be from the instant that the called position accepts the IC call, to the instant that an indicator response (ringback tone stops) is activated at the calling position, and voice communications over the established path can begin. For 95% of the event completions, this event response time shall not exceed 200 msec. For 99.9% of the event completions, this event response time shall not exceed 300 msec.

3.2.2.2.7.3 IC OVR Call Placement/Acceptance Response Time - The response time for these events shall be from the instant that the address is generated at the position, to the instant that the Calling (Placement) and the Called (Acceptance) positions are notified and voice communications can begin over the OVR voice channel established between the positions. For 95% of the event completions, these response times shall not exceed 250 msec. For 99.9% of these event completions, these response times shall not exceed 450 msec.

3.2.2.2.8 IC Circuit Release Time Delay - The response time for this event shall be from the instant that the release signal is emitted at the releasing position, to the instant that the voice circuit is released, the associated positions are released from this connection, and the affected positions receive proper indicator response. For 95% of the event completions, this event response time shall not exceed 250 msec. For 99.9% of the calls terminated, this event response time shall not exceed 350 msec.

3.2.2.2.8.1 RESERVED (See Addendum 1)

3.2.2.2.8.2 RESERVED (See Addendum 1)

3.2.2.2.8.3 RESERVED (See Addendum 1)

3.2.2.2.8.4 RESERVED (See Addendum 1)

3.2.2.2.9 Interphone (IP) Call Setup Response Time

3.2.2.2.9.1 IP Call Placement Response Time

3.2.2.2.9.1.1 Position-to-Trunk IP Call Placement Response Time - The response time for this event, whether it be an individual position-to-trunk IP call or an IP addition to a progressive conference call, shall be from the instant that the address is generated at the position, to the instant that any signaling is initiated at the trunk interface. For 95% of the event completions, this event response time shall not exceed 200 msec. For 99.9% of the event completions, this event response time shall not exceed 300 msec.

3.2.2.2.9.1.2 Trunk-to-Position IP Call Placement Response Time - The response time for this event exclusive of type 5 trunks shall be from the instant that the complete called address is confirmed at the trunk interface to the VSCS, to the instant that the called position is notified (by a call indicator response). For 95% of the event completions, this event response time shall not exceed 200 msec. For 99.9% of the event completions, this event response time shall not exceed 300 msec. For 95% of the event completions, this event response time for type 5 trunks shall not exceed 250 msec. For 99.9% of the event completions, this event response time for type 5 trunks shall not exceed 450 msec.

3.2.2.2.9.1.3 Position-To-Trunk IP OVR Call Placement Response Time - The response time for this event shall be from the instant that the address is generated at the position, to the instant that appropriate OVR signaling is initiated at the Trunk Interface. For 95% of the event completions, this event response time shall not exceed 250 msec. For 99.9% of the event completions, this event response time shall not exceed 400 msec.

3.2.2.2.9.1.4 Trunk-To-Position IP OVR Call Acceptance Response Time - The response time for this event shall be from the instant that appropriate IP OVR signaling is confirmed at the Trunk Interface, to the instant that the called position is notified of the call by appropriate VSCS internal signaling. For 95% of the event completions, this event response time shall not exceed 300 msec. For 99.9% of the event completions, this event response time shall not exceed 400 msec.

3.2.2.2.9.2 IP Call Acceptance Response Time

3.2.2.2.9.2.1 Position-to-Trunk IP Call Acceptance Response Time - The response time for this event exclusive of type 5 trunks shall be from the instant that the called position accepts the incoming IP call, to the instant that the IP call acceptance message signaling is initiated at the trunk interface. For 95% of the event completions, this event response time shall not exceed 250 msec. For 99.9% of the event completions, this event response time shall not exceed 350 msec. For 95% of the event completions, this event response time for type 5 trunks shall not exceed 250 msec. For 99.9% of the event completions, this event response time for type 5 trunks shall not exceed 450 msec.

3.2.2.2.9.2.2 Trunk-to-Position IP Call Acceptance Response Time - The response time for this event, whether it be an individual position-to-trunk IP call or an addition to a progressive conference call, shall be from the instant that the IP acceptance message is confirmed at the trunk interface to the VSCS, to the instant the calling position is notified (by a call indicator response), and voice communication over the established path can begin. For 95% of the event completions, this event response time shall not exceed 200 msec. For 99.9% of the event completions, this event response time shall not exceed 300 msec.

3.2.2.2.10 IP Circuit Release Response Time - The response time for this event shall be from the instant that the release signal is emitted at the releasing position, to the instant that the voice circuit connection is confirmed as released and the releasing position receives proper indicator response. If the releasing position is external to the VSCS, then the response time shall be from the instant that the releasing signal is confirmed at the VSCS-trunk interface, to the instant that the voice circuit connection is confirmed as released and the position within the VSCS receives proper indicator response. For 95% of the event completions, this event response time shall not exceed 250 msec. For 99.9% of the event completions, this event response time shall not exceed 350 msec. Delays outside of the VSCS are not included.

3.2.2.2.11 Dial Tone Response Time For Indirect Access (IA) - When circuit function provides dial tone, the response time for this event shall be from the instant that the IA keypad is activated, to the instant that the dial tone is activated. For 95% of the event completions, this event response time shall not exceed 250 msec. For 99.9% of the event completions, this event response time shall not exceed 350 msec.

3.2.2.2.12 Display Devices Response Time - The response time for this event shall be from the instant that the desired message is present to the display driver, to the instant that the desired message appears on the display device. For 99.99% of the event completions, this event response time shall not exceed 100 msec.

3.2.2.2.13 Touch Entry Device (TED) Detection Response Time - The response time for this event shall be from the instant that the operator's touch action occurs, to the instant that the touch action has been detected. For 99.99% of the event completions, this event response time shall not exceed 50 msec.

3.2.2.2.14 RESERVED (See Addendum 1)

3.2.2.2.15 RESERVED (See Addendum 1)

3.2.2.2.16 RESERVED (See Addendum 1)

3.2.2.2.17 RESERVED (See Addendum 1)

3.2.2.2.18 RESERVED (See Addendum 1)

3.2.2.2.19 RESERVED (See Addendum 1)

3.2.2.2.20 RESERVED (See Addendum 1)

3.2.2.2.21 RESERVED (See Addendum 1)

3.2.2.2.22 RESERVED (See Addendum 1)

3.2.2.2.23 RESERVED

3.2.2.2.24 RESERVED

3.2.2.2.25 RESERVED (See Addendum 1)

3.2.2.2.26 RESERVED (See Addendum 1)

3.2.2.2.27 RESERVED (See Addendum 1)

3.2.2.2.27.1 RESERVED (See Addendum 1)

3.2.2.2.27.2 RESERVED (See Addendum 1)

3.2.2.2.28 Voice Delay - The VSCS one-way intrafacility voice delay time shall not exceed 60 msec for 95% of the event completions, during the PBM and PBH conditions specified in Table II and Table IIa. For 99.9% of the event completions, the VSCS one-way intrafacility voice delay time shall not exceed 70 msec, during the PBM and PBH conditions specified in Table II and Table IIa. For any operational condition such that a position receives the same voice signal through both the air and the system, then the delay for the signal received through the system shall be less than 5 msec for 99.9% of all event completions during the PBM and PBH conditions specified in Table II and Table IIa.

3.2.2.2.28.1 Intrafacility Voice Delay Measurement - The one-way voice measurement shall be from the instant voice enters the transmitting port (position, trunk, or radio port) to the instant the voice is received at the output of the receiving port (position, trunk, or radio port). When PTT is required for voice transmission, the voice delay test signal shall be sent for measurement after the A/G or G/G PTT transmit response time (as specified in Table III) has elapsed.

3.2.2.2.28.1.1 Position-to-Position Voice Delay Measurement - The position-to-position one-way voice delay measurement shall be from the instant that voice is present at the transmitting position's microphone to the instant that the voice is received at the receiving position's headset or loudspeaker.

3.2.2.2.28.1.2 Position-to-Trunk Voice Delay Measurement - The position-to-trunk one-way voice delay measurement shall be from the instant voice is present at the position's microphone to the instant that the voice is received at the trunk output interface. For trunk-to-position, the one-way voice delay measurement shall be from the instant that voice is present at the trunk input interface to the instant that the voice is received at the position headset or the position loudspeaker.

3.2.2.2.28.1.3 Position-to-A/G Interface Voice Delay Measurement - The position-to-A/G interface one-way voice delay measurement shall be from the instant voice is present at the position's microphone to the instant that the voice is received at the VSCS A/G interface. This measurement shall begin after the A/G PTT transmit response time specified in Table III, has elapsed. The A/G interface-to-position one-way voice delay measurement shall be from the instant voice is present at the A/G interface to the instant that voice is received at the position headset or loudspeaker.

3.2.2.2.29 PBX Beep Cycle - The VSCS shall provide an audio beep every 15 seconds on all private branch exchange tie lines to indicate that a conversation is being recorded.

3.2.2.2.30 RESERVED (See Addendum 1)

3.2.2.2.30.1 RESERVED (See Addendum 1)

3.2.2.2.30.2 RESERVED (See Addendum 1)

3.2.2.2.30.3 RESERVED (See Addendum 1)

3.2.2.2.30.4 RESERVED (See Addendum 1)

3.2.2.3 System Errors - Internal errors within the VSCS shall not exceed the limits listed in Table IV and specified in the following paragraphs. Errors external to the VSCS are excluded from these requirements.

Table IV. System Errors

Description	Maximum Error Rate
False Service Disconnect	10^{-6}
False Request For Service	10^{-6}
Incorrect Dial Code Access	10^{-6}
Push-to-Talk Error	10^{-10}

3.2.2.3.1 False Service Disconnects - For 10^6 calls transmitted throughout the system, not more than one false disconnect of a circuit shall occur due to any internal VSCS errors.

3.2.2.3.2 False Request for Service - For each 10^6 user requests for service, not more than one false request for service shall be initiated by internal VSCS errors.

3.2.2.3.3 Incorrect Dial Code Access - The VSCS error rate for transmitting or decoding addresses shall not exceed one erroneous call per 10^6 calls.

3.2.2.3.4 PTT Error Rate - The VSCS error rate for PTT activation and PTT release shall not exceed 10^{-10}.

3.2.2.4 Reconfiguration Timing Requirements - VSCS reconfiguration timing requirements shall be determined based on whether the one-step or the two-step reconfiguration process is selected.

3.2.2.4.1 One-step Reconfiguration Timing Requirements - The time required to perform VSCS reconfiguration using the one-step process shall not exceed one second per position affected nor a maximum of five minutes. During a one-step reconfiguration, a position shall not be without functional communications for more than one second under the traffic loads specified in Tables II and IIa.

3.2.2.4.2 Two-step Reconfiguration Timing Requirements - VSCS shall be capable of performing reconfiguration of communications connectivities in two separate steps, reconfiguration preparation and reconfiguration execution. After the VSCS receives the reconfiguration preparation command, the VSCS shall prepare the requested connectivities for implementation. The timing for reconfiguration shall not exceed one second per position affected to a maximum of five minutes for all positions in a facility under the traffic loads specified in Tables II and IIa. The position-, sector-, area-, and facility-level reconfiguration timing requirements shall exclude delays caused by positions(s) being engaged in an active call. Upon receipt of the reconfiguration execution command, the VSCS shall execute the called-for reconfiguration within five seconds. During reconfiguration a position shall not be without functional communications for more than one (1) second under the traffic loads specified in Tables II and IIa.

3.2.2.5 Degraded Operation - If either unanticipated emergency traffic conditions exceed VSCS traffic capabilities or internal system failures occur, then the VSCS shall service requests on a priority basis to ensure air safety. The VSCS shall assign highest priority to all A/G communications. After A/G communications, the VSCS shall assign decreasing priorities according to the following order: IC; IP; maintenance functions; data collection functions; and support functions, which receive lowest priority.

3.2.2.6 Voice Channel Performance Characteristics - The VSCS voice channel performance shall meet the requirements of the following paragraphs.

3.2.2.6.1 Impedance - Each voice frequency (VF) circuit within the system shall present a nominal impedance to its interface in accordance with the requirements set forth in the interface requirement documents (IRDs).

3.2.2.6.2 Background Noise - Combined hum and noise level of any single receive voice path within a VSCS, measured at the position jacks, with the headset volume control set to nominal, with both ends of the path properly terminated, shall not exceed 16 dBrnC for the C-message weighted noise and 35 dBrn for the 3 KHz flat noise. Combined hum and noise level of any single transmit voice path within a VSCS, measured at the interface with external equipment, with both ends of the path properly terminated, shall not exceed 20 dBrnC0 for the C-message noise and 35 dBrn for the 3 KHz flat noise. This test shall be performed with the Automatic Gain Control (AGC) enabled.

3.2.2.6.3 Idle Channel Noise - With the input terminated in the nominal impedance, noise measured at the output shall not exceed 23 dBrnC0. This test shall be performed with the AGC enabled.

3.2.2.6.4 Impulse Noise - The peak level of impulse-type noise generated within the VSCS, when measured on a single idle voice path, as defined and terminated in accordance with 3.2.2.6.2, shall not exceed one hit within a 30-minute period above a level of 47 dBrnC0. This test shall be performed with the AGC enabled.

3.2.2.6.5 Crosstalk Between Channels - The crosstalk coupling loss between any transmit or receive path of an independent VF circuit or between any digital signal transmit and receive path through VSCS electronics shall be greater than or equal to 72 dB. This test shall be performed with the AGC disabled.

3.2.2.6.6 Frequency Response - The frequency response for all frequencies between 300 and 3000 Hz shall be within the limits (where + equals more loss and - equals less loss) of the 1000 Hz amplitude level measured at the voice channel output for the voice channels defined in Table VIa. Trunk types are described in the VSCS-Trunks IRD. The test input signal shall be at the standard telephony test tone level of 0 dBm0. To protect other services from interference due to frequencies that are above the voice band, the signal applied to VSCS interfaces shall not exceed the limits specified in Table V. This test shall be performed with the AGC disabled.

3.2.2.6.7 Intermodulation Distortion - When measured with the four-tone test method, which involves the transmission of four equal level tones (856, 863, 1374, and 1385 Hz) at a given composite level of -13 dBm0, the intermodulation distortion parameters shall not exceed the values given in Table VI. This test shall be performed twice. The first test shall be performed with the AGC disabled. The second test shall be performed with the AGC enabled.

3.2.2.6.8 Harmonic Distortion - Total harmonic distortion in a voice circuit produced by the second and third harmonics of a 1004 Hz test tone at -9 dBm if injected at a position jack or -9 dBm0 if injected at a voice path interface with external equipment shall be at least 45 dB below the test tone at the point of measurement. The test shall be performed twice. The first test shall performed with the AGC disabled. The second test shall be performed with the AGC enabled.

Table V. Frequency Response Characteristics

Frequency, KHz	Maximum Power Below Zero Transmission Level Point, dB
3.955 to 4.005	-28 (15 dB below - 13 dBm)
4.0 to 10.0	-16
10.0 to 25.0	-24
25.0 to 40.0	-36
Above 40.0	-50

Table VIa. Voice Channel Test Limits

Voice Channel	Test Limits
Radio Interfaces Type 3 SF Tone Burst Trunk Type 4 Trunk Type 4/5 Trunk Type 5 Trunk Type 7 SF Signaling Trunk Type 9 Trunk Type 20 Trunk	-0.5 to +0.6
Type 3 Loop Signaling Trunk Type 8 Loop Signaling Trunk	-1.75 to +4.85
Type 6 CO/PBX Extension Trunk	-1.5 to +2.4
Type 7 DX Signaling Trunk	-1.0 to +1.7
Type 7 4-W E&M Signaling Trunk PABX 4-W E&M Signaling Trunk Same Facility PABX 4-W SF Signaling Trunk Different Facility	-1.5 to +1.7

Table VI. Intermodulation Distortion

Connection	Decibels Below Received Power (max), dB R2*
Position to Position	40
Position to Trunk	45

*R2 is the average of the power level in the 503 to 537 Hz and 2223 to 2257 Hz bands expressed in dB below the received power level.

3.2.2.6.9 Longitudinal Balance - Over the frequency range of 300 Hz to 3000 Hz, the longitudinal balance shall conform to the specifications of Table VII. This test shall be performed with the AGC disabled.

3.2.2.6.10 Gain Tracking Linearity - The linearity of each transmission path through the VSCS shall be such that, for a 1004 Hz sinewave signal, the gain of the VSCS tracks the gain of a 0 dBm0 input signal as specified in Table VIII. This test shall be performed with the AGC disabled.

Table VII. Longitudinal Balance

Frequency, Hz	Minimum Balance, dB
300	58
500	58
1000	58
3000	53

Table VIII. Gain Tracking Linearity

Input Level, dBm0	Gain Deviation (max), dB
+3 to -37	± 0.5
-37 to -50	± 1.0

3.2.2.6.11 Talking State - For a position-to-two-wire-trunk interface, the VSCS shall provide a minimum echo return loss of 18 dB and a minimum single-frequency return loss of 12 dB. For delays over 10 msec, any position-to-two-wire-trunk connection shall have the Talker Echo Path Loudness Loss (TEPLL) vs Talker Echo Path Delay (TEPD) relationship(s) on or to the right of the curves presented for Class A1 systems in Figure 12 and Figure 13 of IEEE STD 823-1989. All measurements are made into each interface. This test shall be performed with the AGC disabled.

3.2.2.6.11.1 RESERVED (See Addendum 1)

3.2.2.6.12 VF Level Regulation - The level of VFs between 300 Hz and 3000 Hz when transmitted and received at positions shall be regulated by the VSCS as follows.

3.2.2.6.12.1 Transmit Level Regulation - Automatic voice level regulation shall be provided in all transmitting voice paths from any position to maintain a level within ± 1.5 dB of the nominal output level measured at the analog output from the position equipment. The nominal output level shall be -9.0 dBm0. The level regulation operating range shall be between +15 dB and -9 dB of the nominal input test tone level. The nominal input test tone shall be 1004 Hz at a level of -9.0 dBm injected at the jack module. Threshold detection circuits shall be included in the position such that when the input signal is below the regulation range, the output shall be attenuated by 9 dB. Regulation shall accommodate a 12 dB sudden increase, and subsequent decrease, in accordance with the following paragraphs. The transmit level regulation transfer function is illustrated in Figure 3-1A. This test shall be performed with the AGC enabled.

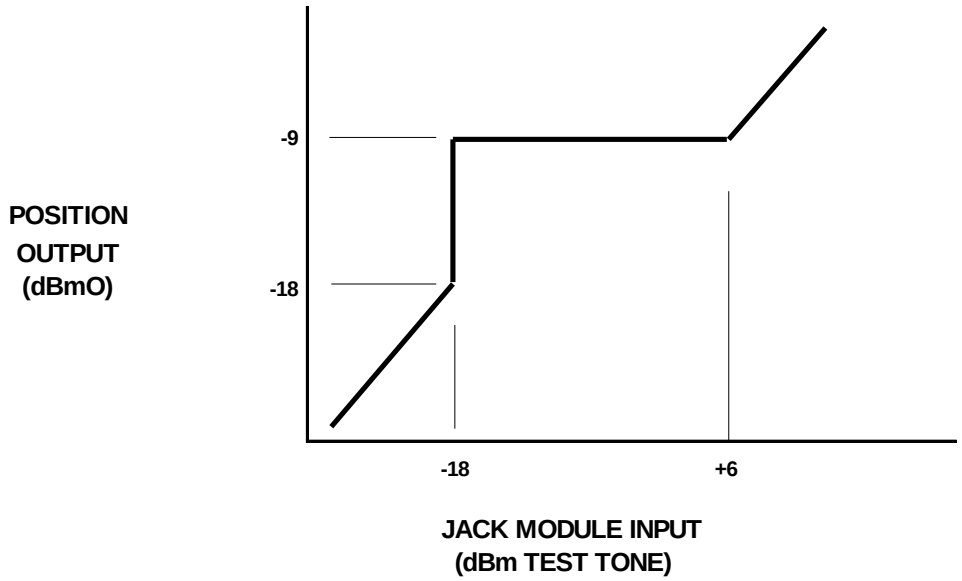

Figure 3-1A. Transmit Transfer Function

3.2.2.6.12.1.1 12 dB Sudden Increase - The instantaneous output level, including transients, shall not increase by more than 5 dB or decrease by more than 3 dB. The output level shall be within ± 0.5 dB of the final steady-state value within 10 msec from the instant of input level change. This test shall be performed with the AGC enabled.

3.2.2.6.12.1.2 12 dB Sudden Decrease - Immediately following the 10 msec stabilization period after the 12 dB increase, and with a sudden 12 dB decrease, the output shall stabilize to within 2 dB of the final steady-state value in not less than 400 and no more than 600 msec from the instant of input level change. This test shall be performed with the AGC enabled.

3.2.2.6.12.2 Receive Level Regulation - Automatic voice level regulation shall be provided, at the interface, in the receiving voice paths from all IP, A/G, or PABX circuits. With up to an 8 dB change in the received level of a 1004 Hz test tone at a level of -9.0 dBm0, the received level measured at the position headset jack shall remain within ± 1.5 dB of the nominal value of -25 dBm with the headset volume control set to nominal. Threshold detection circuits shall be included such that when the input signal is below the regulation range, the output shall be attenuated by 8 dB. The receive level regulation transfer function is illustrated in Figure 3-1B. This test shall be performed with the AGC enabled.

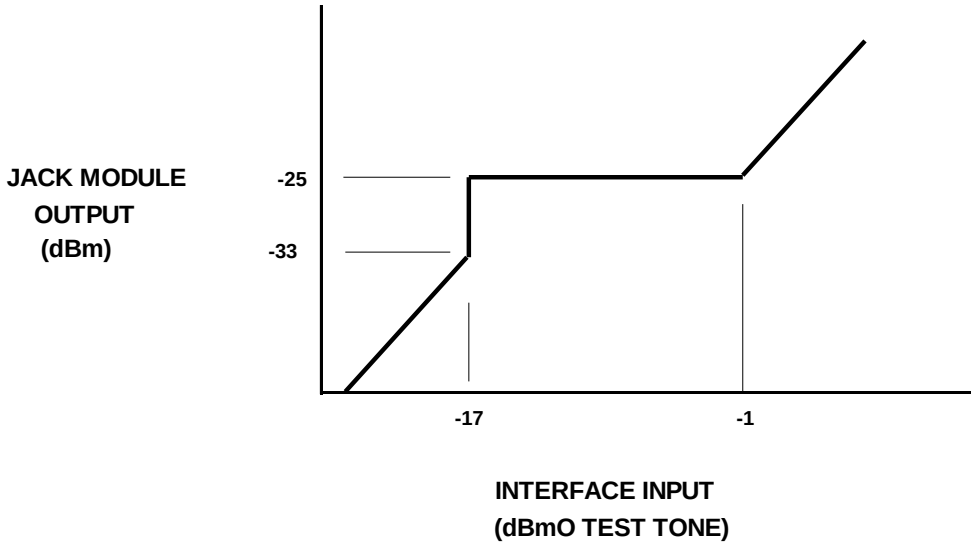

Figure 3-1B. Receive Transfer Function

3.2.2.6.12.3 Multiple Access Level Regulation - Multiple access at a position in an OVR mode, multiple access to IP and multiple distribution of a single trunk to up to the maximum number of positions at a facility shall be such that the cumulative loss due to multiple access in all cases shall not exceed 3 dB. The requirement also applies to conference connections. This test shall be performed with the AGC enabled.

3.2.2.6.13 Measurement Method - The above transmission performance characteristics shall be measured using the standard test method specified in Section 4.8.2 of EIA/TIA-464A, IEEE STD 743-1984, or equivalent. The test equipment shall be built-in in the maintenance position and shall be used to perform measurement of all items specified in 3.2.2.6.1 through 3.2.2.6.12.3.

3.2.2.7 Sidetone - The VSCS shall provide audio sidetone to all (up to four) jacks at a position for all communications emanating from the position. This sidetone shall be generated at the position and shall be such that with the headset volume control set to nominal and with a test tone of 1004 Hz at a level of -9 dBm injected into the transmit path of the position jack, the level measured at the receive path of the position jack shall be -25 dBm
± 1.5 dB. The sidetone shall be provided through the headset or handset and shall not be audible through the position loudspeaker at any time. This test shall be performed with the AGC enabled.

3.2.2.8 RESERVED

3.2.2.9 Headset Volume Control Nominal Setting - The nominal setting of the headset volume controls is defined as follows: With an IC connection between two positions and with a test tone of 1004 Hz at a level of -9 dBm injected into the position jack of the transmitting position, the headset volume control shall be adjusted to provide a level of -25 dBm measured at the receiving position jack.

3.2.3 Reliability, Maintainability, Availability (RMA)

The primary RMA driver for the VSCS shall be availability. The achievement of inherent availability, as stated below, shall drive the reliability and maintainability specifications for this system. The specified availability for the VSCS shall be achieved through system design and shall be demonstrated using reliability and maintainability parameters for the system obtained from analysis, test, and the database of existing systems. Elements of the reliability and maintainability programs that are fixed are specified in 3.7. The specified availability for this system shall be the inherent availability $A_{(i),}$ for each VSCS function:

$$A_{(i)} = MTBCF_{(f)} / [MTBCF_{(f)} + MTTR_{(f)}]$$

where

$A_{(i)}$ = inherent availability

$MTBCF_{(f)}$ = mean time between critical failures for each VSCS functional path

$MTTR_{(f)}$ = mean time to repair for each VSCS functional path

3.2.3.1 Position-level Availability - Availability requirements at the position level are defined as all functions required in the specification. A functional failure has occurred when an operational position cannot provide and maintain the required connectivity and control signals to its assigned functions. A critical functional failure is defined as any functional failure of A/G communications or override call at an individual position which exceeds 200% of the 99.99 percentile column of Table III. All other functional failures are non-critical and shall not exceed 500% of the time specified in the 99.99 percentile column of Table III or one second, whichever is greater. The A/G availability model shall use twenty-four frequencies. Position-level functions shall exhibit the corresponding availabilities specified in Table IX. Non-VSCS hardware/software is not included in VSCS availability determination.

Table IX. Position-Level Availability Requirements

Function	$A_{(i)}$
Radio A/G	0.9999
Intercom	0.9995
Interphone	0.9995

3.2.3.2 System-level Availability - The availability of the VSCS is determined by the number of positions whose critical functions are operationally available. A system failure occurs when one or more critical functions are unavailable in more than 10% of the positions. The system-level availability requirement is based upon the smallest sized system. All systems will exhibit an availability of no less than the system-level availability requirement in Table X. The function and equipment required to switch between the A/G primary switch and the A/G backup switch is included in the system-level availability requirement. The A/G backup switch shall not be considered in the system-level availability calculation. The A/G backup switch shall exhibit an availability of 0.9999999.

3.2.3.3 Support Functions Availability - The availability requirement for support functions is defined as $A_{(i)} = 0.999$ with an MTTR of one hour.

Table X. System-Level Availability Requirements

Function	$A_{(i)}$
System-level	0.9999999

3.3 OPERATIONAL REQUIREMENTS

3.3.1 A/G Communications

3.3.1.1 General Requirements - Each air traffic controller operating position within a facility shall be provided the capability for assignment of A/G communications functions. Assignment of an A/G communications function at a given air traffic controller position shall be controlled by configuration maps as determined by site adaptation data. A/G communications functions shall include, but not be limited to, the following:

a. Selection and deselection of the position's assigned frequencies.

b. M/S transmitter selection for each assigned frequency.

c. M/S receiver selection for each assigned frequency.

d. RESERVED (See Addendum 2)

e. Independent enabling/disabling of transmission for each selected frequency at an operational position.

f. Independent local muting of received voice for each selected frequency at an operational position, for frequencies assigned to split-mode operations by site adaptation data.

g. Remote muting of receivers for selected frequencies.

h. Transmitter/receiver remote site selection for designated frequencies that have radio outlets at more than one remote site.

i. Enabling and disabling of automatic transfer of A/G voice from HS to LS if the operator engages in G/G voice communications.

j. RESERVED.

k. Selection and assignment of BUEC.

l. Selection of UHF or VHF emergency frequencies, or both, for reception or transmission, or both.

m. PTT preemption capabilities for selected frequencies.

n. Manual selection of routing of incoming voice to HS or LS for each selected frequency at a position, for frequencies assigned to split-mode operations by site adaptation data.

o. PTT lockout when A/G transmission is attempted on a frequency that is in use by another position.

p. Visual indication on all assigned frequencies of the presence of squelch break on received voice or PTT confirmation on transmitted voice.

q. Confirmation of PTT, M/S selection, remote and local muting, and frequency selection.

r. RESERVED.

Requirements for each of the above listed A/G communications functions are detailed in the following paragraphs.

3.3.1.1.1 Frequency Selection - Each air traffic controller position that has been assigned A/G communications capabilities shall have the capability to select any frequency or frequencies from those assigned to the position. Frequency assignments for a given operational position shall be resident in the configuration database position map(s). Selection of a frequency at an operational position shall cause the enabling of either the main or standby transmitter, and either the main or standby receiver, whichever is on line.

3.3.1.1.1.1 Assigned Frequency Display - Every frequency that is assigned to a given air traffic controller operational position shall be continuously visible to the operator on the position display. Distinct illuminated conditions shall be provided to enable the operator to distinguish between selected and unselected frequencies available to the position.

3.3.1.1.1.2 Displayed Frequency values - All frequency values shall be displayed with values in MHz and decimal fractions thereof. VHF values shall be displayed to the nearest 0.025 MHz (e.g., 125.550). UHF values shall be displayed to the nearest 0.1 MHz (e.g., 217.3). All frequency indications shall have a decimal point separating the integer and fractional portions of the frequency value.

3.3.1.1.1.3 Frequency Selection Method - An assigned radio frequency shall be selected by a single touch action by the position operator. A selected frequency shall be deselected by individual touch actions that disable the transmission and reception associated with the frequency.

3.3.1.1.1.4 Routing of Incoming Voice - The VSCS shall provide for position operator selection of routing of received voice radio communications on each selected frequency to either the position headset/handset or to the position A/G loudspeaker. A visual indication of the voice routing selected for each selected frequency shall be provided. Incoming voice radio communications shall be routed as selected commensurate with the requirements for automatic transfer of A/G voice routing (See 3.3.1.1.8).

3.3.1.1.1.5 TX/RX Visual Indications - The VSCS shall provide distinct visual indications of the presence of PTT confirmation and receiver squelch break on every assigned frequency at an operational position whether or not the frequency has been selected for use at the position. If the radio interfaces do not provide either or both the PTT confirmation signal and squelch break, the signals shall be generated internally by the VSCS on every selected frequency at an operational position. Visual indication of PTT confirmation on frequencies selected for transmission shall be made after receipt of PTT confirmation. Visual indications shall clearly allow the position operator to distinguish between PTT on those selected frequencies at the position with transmit capabilities enabled and those with transmit capabilities not enabled, and between reception of squelch break on selected frequencies at the position with receive capabilities enabled and those with receive capabilities not enabled.

3.3.1.1.1.6 Frequency Status Display - For each air traffic controller position that has been assigned A/G communications capabilities, the VSCS shall provide access to a frequency status display which provides simultaneous visual indication of real time frequency status for all frequencies selected at that position, up to 24 frequencies. Individual frequency displays shall indicate the frequency value, site designator if multiple sites for a frequency are used, and the selected routing (HS or LS) for the frequency. Frequency status information shall include PTT confirmation, squelch break, PTT lockout and for those radio interfaces that provide a PTT Trunk Lockout signal, a radio interface PTT Trunk Lockout indication.

The frequency status display shall have the capability to allow the position operator to select the transmitter site on a call-by-call basis for multiple site frequencies. All other A/G selections and functions shall be activated via the appropriate touch action(s) to the A/G display. The position operator shall have the ability to enable and disable the frequency status display.

3.3.1.1.2 M/S Transmitter Selection - Every air traffic controller position that has been assigned to have A/G communications capabilities shall have the capability to select either the main or the standby transmitter for each selected frequency at the position.

3.3.1.1.2.1 M/S Transmitter Visual Indication - The A/G display at an operational position shall have a continuously visible indication of main or standby transmitter selection status for every enabled transmitter at the operating position. Frequencies using BUEC shall not have M/S transmitter indications.

3.3.1.1.2.2 M/S Transmitter Selection Method - M/S transmitter selection shall function only for frequencies that have been selected by the position operator and are not using BUEC.

3.3.1.1.3 M/S Receiver Selection - Every air traffic controller position that has been assigned A/G communications capabilities shall have the capability to enable either the main or the standby receiver for each selected frequency at the position.

3.3.1.1.3.1 M/S Receiver Visual Indication - The A/G display at an operational position shall have a continuously visible indication of the main or standby receiver selected status for every frequency selected at an air traffic controller operating position. Frequencies using BUEC shall not have M/S receiver indications.

3.3.1.1.3.2 M/S Receiver Selection Method - M/S receiver selection shall function only for frequencies that have been selected for use by the position operator and which have not been selected for BUEC.

3.3.1.1.4 RESERVED (See Addendum 2)

3.3.1.1.5 RESERVED (See Addendum 2)

3.3.1.1.5.1 RESERVED

3.3.1.1.5.2 RESERVED (See Addendum 2)

3.3.1.1.5.3 RESERVED (See Addendum 2)

3.3.1.1.5.4 RESERVED (See Addendum 2)

3.3.1.1.6 Position Control of Transmission and Reception - The VSCS shall provide the capability for the enabling or disabling of the transmission of voice from a position for any selected frequency. The VSCS shall provide the capability for the enabling or disabling of the reception of voice at a position for any selected frequency. Local disabling of either the transmission or reception at an operational position, but not both, for a selected frequency shall not cause deselection of the frequency at the position. Disabling of both transmission and local reception for a selected frequency at a controller position shall cause the deselection of the frequency at the position. Disabling of transmission or reception for any frequency at any position shall not affect transmission or reception on that frequency at any other position.

3.3.1.1.6.1 Muting of Receivers

3.3.1.1.6.1.1 Muting Indication - The muted status of the receiver for each frequency selected at an operational position shall be continuously visible to the position operator. Remote mute status shall be continuously displayed at each position with the frequency selected regardless of the local mute state of that frequency at the position. Selection or deselection of remote muting shall not alter a position's local mute state for that frequency.

3.3.1.1.6.1.2 Local Muting Selection Method - Local muting of the receiver for a selected frequency at a controller position shall be accomplished by a single touch action by the position operator.

3.3.1.1.6.1.3 Remote Muting - For radio interfaces that provide remote muting capability, the VSCS shall provide air traffic controller positions the capability to remotely mute received voice for specified assigned frequencies at the air traffic controller position. Selection of remote muting for a frequency shall not effect a frequency deselection for that frequency at any position that has the frequency selected.

3.3.1.1.6.2 RESERVED (See Addendum 1)

3.3.1.1.7 RESERVED

3.3.1.1.7.1 RESERVED

3.3.1.1.7.2 RESERVED

3.3.1.1.7.3 Multiple Sites for a Frequency - The VSCS shall provide the capability, for a given assigned frequency at an appropriately classmarked operational position, to access multiple remote transmitter/receiver/ transceiver sites for that frequency through multiple radio interfaces. The VSCS shall provide controls such that only one of the transmitters for the frequency is enabled at a time for all positions having that frequency. A single touch action to a transmitter shall disable the previously selected transmitter and enable the selected transmitter. For operational positions using this feature, and accessing transmitter/receiver/transceiver sites via radio interfaces that provide signal strength information, the VSCS shall provide a voting algorithm to preclude mutual interference on received voice from the enabled receivers on the frequency.

3.3.1.1.7.3.1 RESERVED (See Addendum 1)

3.3.1.1.7.3.2 RESERVED (See Addendum 1)

3.3.1.1.7.3.2.1 RESERVED (See Addendum 1)

3.3.1.1.7.3.2.2 RESERVED (See Addendum 1)

3.3.1.1.7.3.2.3 RESERVED (See Addendum 1)

3.3.1.1.7.3.2.4 RESERVED (See Addendum 1)

3.3.1.1.8 Automatic Transfer of A/G Voice Routing - For operational positions with A/G communications capabilities, the VSCS shall provide for the automatic transfer of the routing of incoming A/G voice from the headset/handset to the position's A/G loudspeaker, during those periods when the position operator is engaged in G/G communications, except incoming override calls, and has also selected incoming A/G to be routed to the position headset/handset, and the receiver is enabled. The position operator shall be provided the capability to

enable and disable automatic transfer of routing incoming A/G voice from the position headset(s) to the position A/G loudspeaker. If the automatic transfer of routing incoming A/G voice from the headset/handset to the position's A/G loudspeaker has been disabled and the position operator is engaged in G/G communications using the position headset/handset and has also selected incoming A/G to be routed to the positions headset/handset, the incoming A/G voice shall be heard with the G/G voice in the headset/handset. Incoming A/G voice shall be automatically routed to the position A/G loudspeaker at an inactive operational Position (See 3.3.3.2, Inactive Position).

3.3.1.1.8.1 Automatic Transfer of A/G Voice-Routing Indication - For operating positions with A/G communications capabilities, the current selection status for automatic transfer of A/G voice routing shall be continuously visible to the position operator.

3.3.1.1.8.2 Automatic Transfer of A/G Voice-Routing Selection Method - Automatic routing transfer of A/G voice shall be enabled or disabled by a single touch action by the position operator.

3.3.1.1.9 RESERVED (See Addendum 1)

3.3.1.1.9.1 RESERVED (See Addendum 1)

3.3.1.1.9.2 RESERVED (See Addendum 1)

3.3.1.1.10 Selection and Assignment of BUEC - The VSCS shall provide access to the BUEC system from each air traffic controller position that has A/G communications capabilities enabled. BUEC selection and frequency assignment shall be accomplished through operator actions using the interactive display device(s). For any given frequency at an operational position, accessing BUEC shall inhibit using any communication control normally provided by the radio interface for that frequency.

3.3.1.1.10.1 RESERVED (See Addendum 1)

3.3.1.1.10.2 BUEC Selection Method - The VSCS shall provide access to BUEC in accordance with the VSCS-BUEC IRD. The position operator shall activate the BUEC selection function with a single touch action. A visual indication shall be provided that shows when the BUEC select function is enabled. A subsequent touch action to a displayed frequency value at the position shall designate the frequency as selected for transfer to BUEC, and disable the BUEC selection function and its visual indication. The BUEC selection function shall be disabled if no frequency designation is made within 15 seconds after the BUEC selection function is enabled.

3.3.1.1.10.3 BUEC Deselection - The use of BUEC for a selected frequency shall be deselected by a single touch action. The M/S transmitter and M/S receiver selection status for the frequency shall revert to the current selection status in effect as determined by the VSCS A/G interface.

3.3.1.1.11 Selection of Emergency Frequencies - The VSCS shall provide every air traffic controller position that has A/G capabilities the capability to access the UHF and VHF emergency frequencies of 243.0 MHz and 121.500 MHz. The VSCS shall provide connectivity to the radio interfaces for the emergency frequency transmitters and receivers from all air traffic controller positions that have the emergency frequencies assigned. The position operator shall have the capability of local muting or enabling reception of voice at the position, for either or both emergency frequencies. If emergency frequencies are assigned to any operational positions within an area supervisor's area of responsibility, then that supervisor shall receive an alarm indication when any of the emergency receivers within that area are not being monitored by at least one operational position.

3.3.1.1.11.1 Emergency Frequency Indications - Emergency frequencies and emergency frequency control areas shall be uniquely marked on operational position interactive displays.

3.3.1.1.11.2 Emergency Transmitter Activation - Transmission on either emergency frequency or both of the emergency frequencies simultaneously shall require a single, continuous, nonlatching touch action by the position operator on the desired emergency frequency select area. Voice from the position shall be transmitted over the selected emergency frequency (frequencies) and over all other frequencies at the position that are selected and have transmitters enabled, for the duration of the operator touch. A visual indication shall be provided to every position operator with emergency frequency assignments to notify of the activation of an emergency frequency transmitter.

3.3.1.1.11.3 Emergency Transmitter Lockout - Activation of a transmitter for either emergency frequency at an operational position shall lock out use of that transmitter at all other operational positions for the duration of the transmission. The position operator at a locked-out position shall be provided visual and audible indications that the emergency frequency access has been locked out, if PTT is attempted on the emergency frequency.

3.3.1.1.12 PTT - All voice transmission of A/G communications, except emergency frequency communications, at an air traffic controller position shall be activated by either a hand-activated PTT device or a foot-activated PTT device at the discretion of the position operator.

3.3.1.1.12.1 PTT Lockout - Except cases where PTT preemption is permitted by classmark, an attempt by a position operator to transmit on a frequency currently being used for transmission (PTT active) by another position operator shall cause a PTT lockout of that frequency at the attempting position. The position operator at the attempting position shall be provided a visual and an audible indication that the transmission on the frequency has been locked out. The PTT lockout audible indication shall be distinct from any other audible indications, and shall be supplied for the duration of the PTT lockout on that frequency. PTT shall not be locked out on other frequencies selected for transmission at the positions that are not currently being used for transmission by other position operators.

3.3.1.1.12.2 PTT Preemption - Every frequency assigned to an air traffic controller position shall be classmarked as either possessing or lacking PTT preemption relative to that position's use of the frequency. A PTT action by the position operator activating transmission on a frequency designated as preempting shall cause the termination of any transmission in progress on that frequency at any other air traffic controller position. The position operator at a position whose transmission has been preempted shall receive distinct visual and audible indications that preemption has occurred, and shall be provided the preempting conversation. PTT preemption, if actuated, shall be noncontendable, even by positions processing the same frequency's PTT preemption classmark. PTT preemption as described herein shall be distinctly different from that described in 3.4.9.2.1.

3.3.1.1.12.3 Radio Interface PTT Trunk Lockout - For radio interfaces that provide a PTT Trunk Lockout signal, the VSCS shall provide distinct visual and audible indications, at an operational position attempting PTT, of a radio interface that is providing the PTT Trunk Lockout signal. The audible indication shall be supplied continuously to the position for the duration that PTT is attempted on that frequency.

3.3.1.1.12.4 Radio Interface PTT Lockout - The PTT lockout requirements shall apply only for those configurations where multiple operational positions have access to a given assigned frequency through a single radio interface. The PTT lockout requirements shall not apply to a given assigned frequency at multiple operational positions accessing the given frequency through separate radio interfaces.

3.3.1.1.12.5 PTT Receiver Muting - During the time that PTT is active for a radio frequency, all received radio voice for that frequency will be completely muted at the radio interface. This function shall also apply when the frequency has been selected on BUEC. For radio interfaces that provide a PTT Trunk Lockout signal, if a PTT

Trunk Lockout signal is received from the radio interface while PTT is active, the received radio voice path shall be enabled.

3.3.1.1.12.6 RESERVED (See Addendum 1)

3.3.2 G/G Communications

3.3.2.1 General Requirements - Each operational position within a facility shall have the capability for assignment of G/G communications functions. Assignment of G/G communications at a given operational position shall be in configuration maps as determined by site adaptation data. G/G communications shall include, but not be limited to, the following:

a. Call types

    1. Intercom
    2. Interphone

b. Call modes

    1. Direct access
    2. Indirect access
    3. Voice calls

c. Call features

    1. Override
    2. Hold
    3. Forwarding
    4. RESERVED
    5. Conferencing
    6. Common answer (CA) queuing
    7. Call release
    8. Routing of incoming G/G calls to HS or G/G LS
    9. Routing of incoming G/G OVR calls to HS or G/G LS
    10. Recording of position relief briefings
    11. Position voice monitoring
    12. PTT for G/G communications
    13. Manual ring assignment

Requirements for the G/G communications listed above are detailed in the following paragraphs.

3.3.2.1.1 Intercom/Interphone (IC/IP) - The VSCS shall provide each operational position the IC/IP communications. Access to each of these shall be determined by configuration database map(s) for the positions. Call mode and call feature restrictions shall be controlled by classmarks assigned by authorized personnel and resident in the position maps.

3.3.2.1.2 Routing of Incoming G/G Voice - The VSCS interactive display shall provide separate HS/LS routing selectors for incoming OVR calls and for incoming non-OVR calls. Incoming voice call routing, however, shall be in accordance with 3.3.2.2.9 and 3.5.2.2.2.6.2.

3.3.2.1.2.1 Selection of G/G Voice Routing - The position operator shall be able to select the routing of the incoming OVR voice communications path with a single touch action. The position operator shall be able to select the routing of all other incoming G/G voice communications with a single touch action. Successive touch actions for either selection shall toggle the routing between the G/G LS at the position and the HS(s) at the position.

3.3.2.1.2.2 Indication of Voice Routing - The position operator shall be provided with continuous visual indication of the current selected G/G incoming voice communications path routing to either the G/G LS or the HS(s) at the position for both incoming OVR communications and "all other" incoming G/G communications.

3.3.2.1.2.3 Incoming G/G Call Indication - All incoming G/G calls shall be indicated by a distinct visual and audio indication. Visual and audio indications for incoming override calls shall be as specified in 3.3.2.2.3.5. Visual and audio indications for incoming non-override calls shall be as specified below.

3.3.2.1.2.3.1 Visual Indications For Incoming G/G Calls - All incoming G/G non-override calls shall be indicated by a distinct visual indication at the appropriate touch response area/call designator. If the DA for a calling party is on an undisplayed G/G page, a visual indication of the incoming call shall be provided on a current page.

3.3.2.1.2.3.2 Audio Indications For Incoming G/G Calls - All incoming calls, except overrides and voice calls, shall be indicated by sounding the chime at the called position, if it has been enabled by the position operator. Except where otherwise specified, the chime shall sound until the call is answered or the calling party disconnects. For incoming IP calls, on trunk types that do not have supervisory signaling, a call that is not answered within a suitable timeout period shall be automatically disconnected.

3.3.2.1.2.4 Position Relief Briefing Recording - The VSCS shall provide for the recording of position relief briefings between the operator going off duty at a position and the operator assuming duties at that position. While the position relief briefing recording function is active, all conversation between the two or more operators at the position shall be recorded in accordance with the VSCS-REC IRD (See 3.6.9). Activation of the position relief briefing recording function shall in no way interfere with incoming or outgoing A/G or G/G transmissions at the position. During a position relief briefing, audio sidetone shall be provided to all jacks at the position in accordance with 3.2.2.7. Where a conflict exists between 3.3.2.1.2.4 and 3.4.9.2.3, Jack Preemption, 3.4.9.2.3 shall take precedence, and recording of the preemptable jacks shall cease for the duration of the preemption.

3.3.2.1.2.4.1 Position Relief Briefing Recording Activation - The prerequisite for activation of position relief briefing recording at a position shall be headsets plugged into any two (or more) of the four position jacks. The position relief briefing recording shall then be activated by a single touch action by the position operator. A continuous visual indication shall be provided for the duration of the position relief briefing. Position relief briefing recording shall be deactivated by a single touch action by the position operator or by the removal of all but one headset from the position jack modules.

3.3.2.1.2.5 Position Voice Monitoring - The VSCS shall provide the capability for any operational position to monitor all voice communications directed to and emanating from any other position(s) within a facility. Access to position voice monitoring at designated positions shall be defined and restricted by classmarks assigned by authorized supervisory personnel and resident in the configuration database map(s) for the position.

3.3.2.1.2.5.1 Position Voice-monitoring Restrictions - Position voice monitoring of any operational position by any other operational position shall in no way alter or degrade A/G or G/G communications at the monitored position. The operational position being monitored shall receive no visual, audible, or other indication that the position is being monitored.

3.3.2.1.2.5.2 Position Voice-monitoring Access - Access to position voice monitoring at an air traffic controller position shall be provided by DA or IA. DA position voice monitoring shall be provided by a single touch action to an appropriately marked and classmarked DA designator. IA position voice monitoring shall be provided, position classmark permitting, by entering the position voice-monitoring function code, then entering the number of the position to be monitored. Position voice monitoring shall be suspended if the monitoring position initiates any A/G or G/G communication or answers any non-OVR G/G communications. Position voice monitoring, if selected, shall be resumed after termination of the communication causing the suspension. Position voice monitoring shall not be suspended when the monitoring position receives an incoming override call or an incoming A/G call. Position voice monitoring shall be terminated by individually terminating each active voice-monitoring selection. While the position voice-monitoring function is active, the position operator at the monitoring position shall be provided a continuous visual indication that position voice monitoring is in progress, along with the designation of the position being monitored.

3.3.2.1.2.5.3 RESERVED (See Addendum 1)

3.3.2.1.2.5.3.1 RESERVED (See Addendum 1)

3.3.2.1.2.6 PTT for G/G Communications - All voice transmission of G/G communications at an operational position using latching DA activators shall be enabled only by either a hand-activated or foot-activated PTT device. For G/G calls requiring PTT, no voice or other signal shall be transmitted from the position over G/G unless PTT is activated at the position.

3.3.2.1.2.6.1 PTT for G/G DA - DA call activations that require PTT shall emulate a latching pushbutton. A single touch action shall activate the call, a PTT activation shall be required to transmit voice on the circuit, and call release shall be effected as described in 3.3.2.2.2. For the time interval that the G/G PTT feature is enabled at a position with A/G communications enabled, PTT shall not cause transmission of voice on any frequencies selected at that position. Release of the G/G call shall re-enable the PTT feature for A/G communications.

3.3.2.1.2.6.2 RESERVED (See Addendum 2)

3.3.2.1.2.7 RESERVED (See Addendum 2)

3.3.2.2 IC/IP - The VSCS shall provide an IC to permit any operational position within a facility to establish voice communications with any other position within that facility. The VSCS shall provide an IP to permit any operational position within a facility to establish voice communications to any position at another facility. Access to IC and IP communications at an operational position shall be through DA or IA, or both.

3.3.2.2.1 Active IC/IP Calls - A position active call is an IC/IP call that a position operator can release by a single touch action at the position. Monitoring, incoming OVR calls, and calls in a HOLD status are not, by this definition, position active calls. An operational position shall be permitted to engage in only one position active call at a time. Initiation of an IC/IP call by DA or IA shall cause the release of any position active calls in progress at the position.

3.3.2.2.2 Call Disconnection - Position active calls shall be disconnected by any operator release method defined in the following paragraphs.

3.3.2.2.2.1 Call Release Designator - Position active calls shall be disconnected by a single touch action of the call release designator.

3.3.2.2.2.2 DA Call Designator Release - Position active calls shall be disconnected by a single touch action to the active DA call designator or to the active call designator in the incoming Common Answer (CA) queue area.

3.3.2.2.2.3 Release by Initiating a Call - Position active calls shall be disconnected by the initiation of another DA or IA call at the position.

3.3.2.2.2.4 Release by Answering a Call - Position active calls shall be disconnected by any touch action required to answer an incoming call at the position.

3.3.2.2.2.5 Release by Resuming a Call - Position active calls shall be disconnected by any touch action that resumes a call that had previously been placed on HOLD.

3.3.2.2.2.6 Release Indications - Indication of call release shall be provided to a position operator by the cessation of any BLINK or other active call status indication.

3.3.2.2.2.7 Last Party Release - For intra-VSCS calls, for VSCS calls to and from interfacing systems and inter-VSCS calls on trunks equipped with appropriate signaling, the VSCS shall provide disconnection of a G/G call when, with the exception of OVR calls and meet-me conferences, either of the last two parties on the call performs any of the release actions outlined. The remaining party on the call shall not be required to take any action to disconnect the call. The VSCS shall recognize disconnect signals where provided by other interfacing systems.

3.3.2.2.3 Direct Access (DA) - All IC and IP circuits shall be accessible via DA. Each DA shall require a single touch action by the position operator to initiate or terminate a call. Each operational position shall be provided the capability to access at least 50 DA G/G circuits. The actual number of DA circuits that may be used at an operational position shall be determined by DA assignments in the position's configuration map(s).

3.3.2.2.3.1 Number of DA Selectors - The VSCS display function shall provide at least 50 DA communication selectors at each operational position. DA selectors, their functions, and limitations shall be assigned to each operator position in the position configuration map(s). DA identifiers, functions, and limitations shall be defined by classmarks resident in the configuration database maps for the operational positions. All assigned DA selectors, or a minimum of 25, whichever is less, shall be immediately available for selection at any time.

3.3.2.2.3.2 RESERVED (See Addendum 1)

3.3.2.2.3.3 DA OVR - The VSCS shall provide each operational position the capability of placing IC/IP DA OVR calls to any other operational position for which the calling position has DA OVR assignments. The voice of the overriding party shall not be transmitted over any A/G communications in progress at the overridden position. The DA OVR assignments at a given operational position shall be as defined by the configuration map(s) for that position. DA OVR calls shall be disconnected (released) by the calling party only; an overridden party shall neither be required nor permitted to disconnect or transfer any incoming OVR call.

3.3.2.2.3.3.1 DA OVR Call Initiation - The VSCS shall provide for DA OVR calls to be initiated at a position using either latching or nonlatching touch activations. DA selectors shall be distinctly marked to indicate their OVR capability.

3.3.2.2.3.3.2 Nonlatching DA OVR Call Initiation - DA OVR calls classmarked to require nonlatching touch activations shall be initiated by the touch action and released by cessation of the touch action; the position microphone of the position headset/handset shall be active for the duration of the touch action.

3.3.2.2.3.4 OVR Call Answering - No touch actions or PTT activations shall be required of a position operator to answer any incoming OVR call.

3.3.2.2.3.5 OVR Call Indications - The VSCS shall provide an audible zip tone (0.2 second burst of dial tone) and a visual indication of an incoming OVR call at an operational position. A visual indication and an audible modified zip tone distinct from those for the first incoming OVR call shall be provided to the position operator at the called position for any additional incoming OVR calls. The VSCS designator(s) of the overriding caller(s) shall be displayed at the called position for the duration of time that an OVR call is in progress.

3.3.2.2.4 Indirect Access (IA) - Both IC and IP circuits shall be accessible via IA. IA requires using the IA keypad to initiate a call or a control function.

3.3.2.2.4.1 IA Call Initiation - Any IA call from a position shall be initiated by activating the IA keypad, then entering the number sequence for the desired call destination.

3.3.2.2.4.1.1 IA Access Keypad Enable - The IA keypad device shall be manually enabled for input by activation of an IA or equivalently marked key. In addition to manual activation, the IA keypad shall be automatically enabled in response to a user request for a function or call type that requires an IA dial sequence to complete the request. Upon manual or automatic enabling of the IA keypad, the pushbuttons shall become backlit as visual indication that the IA keypad is active for input. Audible feedback, such as a dialtone, shall not be used to indicate the IA keypad is active for input. Enabling the IA keypad shall clear any previous entries and status messages that may be present on the keypad alphanumeric display, and shall cause a reset for any number sequences that may have been entered prior to re-enabling.

3.3.2.2.4.2 IA Call Timeout - The IA keypad shall be disabled for acceptance of input if 15 seconds have elapsed since activation of the IA keypad or since the last digit was entered, whichever is later, prior to a complete dialing sequence being entered, or upon completion of a dialing sequence. When the destination, identified by the number sequence, is an IP that requires additional dialing , the IA keypad shall remain enabled and the timeout and automatic disable features shall not apply.

3.3.2.2.4.3 IA OVR Calls - The VSCS shall provide for the capability of initiating OVR calls using IA from any operational position. The voice of the overriding party shall not be transmitted over any A/G communications in progress at the overridden position. IA OVR shall be initiated by entering an OVR function code, or equivalent, preceding the dialing sequence. Answering of OVR calls initiated by IA shall be as described for answering OVR calls.

3.3.2.2.4.4 Common Answer (CA) Queue - An Incoming call (IA or DA) to an operational position that does not have a corresponding DA touch area for answering the call (where answering is required) shall be directed to the called position's CA queue.

3.3.2.2.4.4.1 Caller Identification (ID) - The VSCS position designator of the calling source shall be displayed on the G/G communications CA queue display area of the called position. Where call source information is not available, the line/trunk designator for that incoming call shall be displayed on the CA queue area. Caller IDs displayed in the CA queue area shall not be shifted from one displayed queue position to another as a result of any changes in the number of calls in the queue. The CA queue area shall be capable of displaying at least 12 alphanumeric characters in each queue position.

3.3.2.2.4.4.2 CA Queue Depth - Provision shall be made to accommodate up to four calls in the position CA queue, including an active CA queue call and queue calls on HOLD. When the answer queue is full, incoming calls that would normally be directed to the position CA queue shall not be connected, and a busy indication shall be sent to the calling party.

3.3.2.2.4.4.3 CA Queue Selection - The position operator shall have the capability to select any call in the answer queue in any order for answering, and to cause the automatic selection of the pending call that has been in the CA queue for the longest time.

3.3.2.2.5 Call HOLD - The VSCS shall provide the capability for a position operator to place a position active call, including conference calls but excluding OVR and voice calls, in a HOLD status with a single touch of the HOLD area. The position operator shall be provided a continuous visual indication of the call indicator at the operational position that a call is in a HOLD status for the duration of time that a call is on HOLD. A CA queue call placed on HOLD shall retain its position in the CA queue.

3.3.2.2.5.1 Resuming Call on HOLD - The position operator shall be provided the capability to resume a call on HOLD by a single touch action to the call designator for the desired call. Resumption of a call on HOLD shall cause the disconnection of any position active calls that may be in progress. Automatic call answer queue selection shall not affect CA queue calls on HOLD.

3.3.2.2.6 Call Forwarding - The VSCS shall provide the capability of any position operator to enable the call forwarding feature for that operational position. All G/G calls directed to a position with the call forwarding feature enabled shall be redirected to a designated destination position within the facility. Call forwarding shall not affect the continued use of any A/G functions at the operational position. Call forwarding shall be restricted to forwarding to operational positions within the same facility. A position having once initiated call forwarding shall automatically be released by the VSCS from receiving subsequent G/G calls.

3.3.2.2.6.1 Enabling Call Forwarding - A position operator shall be provided the capability to enable call forwarding at an operational position. The forwarding destination shall be designated by a single touch action to a DA designator for the destination position, or by entering the destination position number on the IA keypad.

3.3.2.2.6.2 Disabling Call Forwarding - A position operator shall be provided the capability of disabling the call forwarding function at an operational position by using an IA code. Additionally, if no forwarding destination is designated within 10 seconds after enabling of the call forwarding function at an operational position, or if any other G/G function is selected, then the call forwarding function shall be disabled. Call forwarding discontinuance shall be controlled by the initiating position or by the supervisory or maintenance positions classmarked for that capability.

3.3.2.2.6.3 Call Forwarding Indications - For the duration of time that call forwarding is in effect at an operational position, a message shall be provided on the G/G display at the position indicating that call forwarding is in effect with the designator of the destination position. The cognizant area supervisor shall be provided an indication when an operational position has enabled call forwarding, and when that position subsequently disables call forwarding.

3.3.2.2.6.4 Call Forwarding Closure - The VSCS shall provide internal controls to prevent closure of call forwarding. Position-to-position call forwarding shall not be permitted to form a closed forwarding loop. An operational position shall not be permitted to be the ultimate recipient of its own call forwarding. The position operator at the operational position attempting to enable call forwarding that would cause closure shall be provided a notice that forwarding to the designated position is not allowed due to forwarding closure.

3.3.2.2.6.5 Call Forwarding Chains - The system shall not restrict the use of call forwarding under any conditions except those detailed in 3.3.2.2.6.4. In particular, a position to whom another position or positions have forwarded their calls shall be permitted to forward its calls, thus creating a call forwarding chain; provided the restrictions in 3.3.2.2.6.4 are not violated. Similarly, the system shall permit call forwarding chains created when a position forwards its calls to a position whose calls are already forwarded, provided the restrictions in 3.3.2.2.6.4 are not violated. In the case of call forwarding chains, the system shall direct calls in accordance with the chain; that is, calls addressed to a position whose calls are forwarded shall be directed to the ultimate position in the chain, rather than the next position in the chain.

3.3.2.2.7 RESERVED

3.3.2.2.7.1 RESERVED

3.3.2.2.7.2 RESERVED

3.3.2.2.7.3 RESERVED

3.3.2.2.8 Conference Calls - The VSCS shall provide the capability for any position operator to initiate and participate in conference calls, up to the limits given in 3.5.2.2.2.5, Conferencing. Two types of conferencing capabilities shall be provided: progressive conferencing and meet-me conferencing. Access to conferencing capabilities at an operational position shall be defined and limited by classmarks in the position map(s) for the position. IA and DA access to the conference calls shall be provided. A visual indication of participation in a conference call shall be provided to each position operator while active in a conference.

3.3.2.2.8.1 Progressive Conferencing - The VSCS shall provide the capability for authorized operational positions to initiate progressive conferences by a single touch action or by entering an appropriate IA function code sequence, or both. All non-OVR IA and non-OVR DA calls initiated at the operational position where the conference function is enabled, and answered by the called positions, up to the conference limit of the VSCS or of the position, whichever is less, shall become participants in the conference call. After selecting a conferee via DA, the system shall permit the originator to select the next DA or IA conferee without waiting until the previous conferee has answered. After selecting a conferee via IA, the system shall permit the originator to select the next DA conferee without waiting for the previous conferee to answer. The originator shall be provided the means to cancel any selected conferee who has not yet answered the call.

3.3.2.2.8.2 Meet-me Conferencing - The VSCS shall provide the capability for operational positions to participate in meet-me conferences by a single touch action or by entering an appropriate IA function code sequence, or both. A conference bridge, or equivalent, with the feature that any operational position, up to the conference limit of the VSCS, accessing the bridge becomes party to any conference on the bridge, shall be provided.

3.3.2.2.8.3 RESERVED (See Addendum 2)

3.3.2.2.8.4 Conference HOLD - The VSCS shall provide the capability for any participant in a conference call to suspend participation in the conference call by activation of the HOLD function at the position. Activation of the conference HOLD function shall not affect the continued participation in the conference by any other operational position. The VSCS shall provide the capability for a position operator to answer any incoming G/G communication while the position is in a conference HOLD status. A continuous visual indication (WINK) of the conference selection indicator shall be provided for the duration of time that the conference is active and the position conference HOLD is in effect at an operational position. Participation in the conference call at an operational position shall be resumed by a single touch action to the WINKING conference selection indicator.

3.3.2.2.8.5 Release From Conference - Any participant in a conference call shall be provided the capability to release from the conference call at any time, without affecting the continued participation in the conference by any other operational position.

3.3.2.2.8.6 RESERVED (See Addenda 1 & 2)

3.3.2.2.9 Voice Calls - The VSCS shall provide the capability for designated operational positions to initiate voice calls by DA, or by entering an appropriate IA function code sequence. Incoming voice calls shall be heard on the G/G LS at all those operational positions that are on the voice call circuit and are designated to receive the incoming voice signal (via the configuration map). A unique, distinct visual indication identifying the voice call shall be provided on a DA selector at each called position on the voice call circuit. Access to voice call circuits shall be as determined in the position configuration map(s) from site adaptation data.

3.3.2.2.9.1 Answering Voice Calls - The VSCS shall provide the capability for the position operator at any called position on a voice call circuit to answer the voice call by a single touch action to the voice call indication at a called position. A distinct visual indication of voice trunk in use shall be provided to all positions within the facility of the voice call initiator with access to the voice trunk for the duration of time that the trunk is in use. When a voice call is answered, the voice path for the voice call at an answering position shall be directed to the selected G/G incoming voice path routing at that position, and removed from the G/G loudspeakers at all positions on the voice call circuit. Any position operator on the voice call circuit shall have the capability to join the voice call in progress, while the voice call circuit is active, by a DA touch action.

3.3.2.2.9.2 Release From Voice Calls - Each active participant in the voice call, except the last participant, shall be required to release from the voice call by any of the defined disconnect methods. For inter-VSCS voice calls, the VSCS shall provide disconnection of the last participant when either of the last two parties on the call performs any of the release actions specified in 3.3.2.2.2, Call Disconnection.

3.3.2.2.9.3 Voice Call Indications - The VSCS shall provide a visual indication to all called parties on a voice call circuit until at least one party answers the call. Every position that answers the voice call shall be provided a distinct visual indication of participation in the voice call for the duration of time that the position is participating in the voice call. After any position on the voice call circuit answers the call, then all other operational positions on the voice call circuit that have not answered (or have answered and released) the voice call shall be provided a distinct visual indication (STEADY) of the continued use of the voice call circuit for the duration of time that the circuit is still active.

3.3.2.2.10 Manual Ring Circuits - For those calls initiated at an operational position on lines requiring manual ring, the VSCS shall provide the capability for the calling position operator to invoke the manual ring by a nonlatching touch action. The manual ring feature shall be available at all times during the interval between initiation of a manual ring call and the call being released by the calling party.

3.3.2.2.11 IA Special Functions - For functions at an operational position for which it is not practical nor desirable to maintain continuous direct operator accessibility to the function, the VSCS shall provide IA entry sequences to effect the desired functions in accordance with the VSCS numbering plan. The use of IA special functions at an operational position shall not affect any A/G or G/G communications that may be in progress at the position.

3.3.2.2.11.1 Display Interchange - For interactive display designs using two displays with identical technologies, the VSCS shall provide an IA special function to enable the position operator at an operational position to cause the interactive display features on either display to be exchanged with those on the other display.

3.3.2.2.12 VSCS Numbering Plan - A comprehensive numbering plan for the VSCS shall include the following features:

a. Access to all operational positions at any facility.

b. Minimum-length number sequence adequate for proposed facility sizing.

c. Abbreviated "dialing" for frequently used PSTN and interfacility calls.

d. Access to IA control functions

e. Access to functions specified under requirements for supervisory positions.

f. Following a logical plan that will lend itself to ease of use. For example, the dial code for a position could include the ATC sector number as part of that code.

g. Compatibility with numbering plans of switching systems that interface with the VSCS (e.g., ICSS, WECO 300/301, etc.). Number aliases, translation, or other methods are acceptable in meeting this requirement.

h. RESERVED

3.3.2.2.13 RESERVED (See Addendum 1)

3.3.3 Other Operational Requirements

3.3.3.1 RESERVED

3.3.3.2 Inactive Position - An operational position within a given configuration shall be considered inactive for input when no voice input devices (i.e., headset or handset) are plugged into the VSCS jack module. Where no conflict exists with the control of multiple-position requirements, the interactive display, the IA keypad, PTT switches, and all other VSCS input devices shall be functionally inoperative at an inactive operational position.

3.3.3.2.1 RESERVED (See Addendum 2)

3.3.3.3 Selective Signaling Trunk Circuits - The VSCS shall provide the capability for G/G IP access, for any trunk that utilizes selective signaling, to at least 5 operational positions. Any position operator on such a selective signaling trunk circuit shall have the capability to join a call in progress on the selective signaling trunk circuit, while the selective signaling trunk circuit is active, by a DA touch action or IA dial sequence.

3.3.3.4 Trunk-In-Use Indications - For any IP trunk circuit accessible by more than one operational position, the VSCS shall provide a continuous visual indication of circuit-in-use to the other operational position(s) having access to that circuit for the duration of the call. The visual indicator shall distinguish between the call placed (but not yet answered) and the call in progress (call answered) states. Further, the trunk-in-use indicators provided to nonparticipants shall be distinct from the visual indicators (call placed, call in progress) provided for the call participants. The trunk-in-use indicator shall be provided for all trunks for which the trunk interface supports this capability.

3.3.3.5 Trunk Selection - At the initiation of a G/G IP call, the VSCS shall have the capability to automatically select an available trunk from a group of trunks. This capability shall not eliminate the use of dedicated IP trunks.

3.3.3.6 A/G and G/G Screen Toggling - Where two pages of A/G frequencies are assigned to a position, the operator shall be able to toggle from one page to the other with a single touch action. Where two pages of DAs are assigned to a position, the operator shall be able to toggle from one page of DAs to the other with a single touch action.

3.3.3.7 RESERVED (See Addendum 1)

3.3.3.8 RESERVED

3.3.3.9 RESERVED (See Addendum 1)

3.3.3.9.1 RESERVED (See Addendum 1)

3.3.3.9.1.1 RESERVED (See Addendum 1)

3.3.3.9.2 RESERVED (See Addendum 1)

3.3.3.9.2.1 RESERVED (See Addendum 1)

3.3.3.9.2.1.1 RESERVED (See Addendum 1)

3.3.3.9.2.1.2 RESERVED (See Addendum 1)

3.3.3.9.2.1.3 RESERVED (See Addendum 1)

3.3.3.9.3 RESERVED (See Addendum 1)

3.3.3.10 RESERVED

3.3.3.10.1 RESERVED

3.3.4 Ancillary Position Operations

In addition to the ATC communications, the VSCS shall provide communications connectivity to the ancillary (user) positions provided in 3.4.4, Ancillary Positions.

3.4 ENTRY AND DISPLAY FUNCTION REQUIREMENTS

3.4.1 General

3.4.1.1 Communications Access - The VSCS entry/display function shall provide for user access to A/G and G/G communications, and to all user control processing and entry/display implementation.

3.4.1.2 Human Interface - The entry/display function shall provide the human interface to the VSCS. The VSCS human interface is defined to be all displays, data entry devices, command entry devices, and voice transducer devices and their controls with which an operator accesses or uses the services of the VSCS.

3.4.1.3 Status - The entry/display function shall have the capability to provide the operational status of A/G and G/G communications to the user.

3.4.1.4 VSCS Database Access - The entry/display function shall provide access to authorized personnel to the VSCS configuration database for creating, modifying, and implementing configuration and reconfiguration map data.

3.4.1.5 Scope of the Entry/Display Function - The VSCS entry/display function shall consist of all hardware, software, and firmware that comprise or directly support the VSCS human interface.

3.4.2 Human Factors

Human factors requirements for operator controls and displays shall comply with MIL-STD-1472, 5.1 through 5.5 and 5.15, except where superseded or extended by a requirement or requirements of this specification. If a conflict exists in the audio display parameters in MIL-STD-1472 and the transmission parameters of 3.2 of this specification, then the audio display standards of MIL-STD-1472 shall apply.

3.4.2.1 RESERVED

3.4.2.2 Conformance to System Level Specification - The System Level Specification (FAA-ER-130-005H-AP) shall be used as a guideline to ensure that the VCE is in conformance with sector suite human factors requirements. Conflicting requirements shall be identified in writing with recommendation to the Government for review and resolution.

3.4.2.3 Additional Human Factors Requirements

3.4.2.3.1 Interactive Display - Operator control of the VSCS communications features and functions shall be accomplished by means of an interactive entry/display and by an IA keypad device. Overlay-type touch entry devices (TEDs), if used, shall meet the additional requirements stated below. The device shall meet all specifications over the entire usable interactive entry/display surface.

3.4.2.3.1.1 TED Physical Requirements - The TED mounting shall prevent parallax between the touch detection plane and the display device screen when viewed from a normal operator's position. The TED shall have a nonglare, nonabradable touch surface that allows a minimum 60% light transmission. The touch surface shall be impervious and scratch-resistant to fingernails, pens, pencils, or any other object that may be used for touch activation. The touch entry surface shall permit cleaning with, and not be affected by, commercially available cleaning compounds.

3.4.2.3.1.2 TED Touch Detection - The TED shall be capable of responding to both momentary and continuous touch by a finger or inert pointer with an activating cylinder of from 0.25 inches to 1.0 inches in diameter. The assumed touch point shall be within 1/16" of the centroid of the touched area. Momentary touch shall provide latching pushbutton equivalency, and continuous touch shall provide nonlatching pushbutton equivalency. The TED shall be capable of detecting touch actions as specified for the events in Table III. The TED or its associated software shall provide detection of multiple touch and touch location movement. Simultaneous inputs to the TED shall result in an error indication. The VSCS shall provide visual feedback to verify number and function sequences input by the operator.

3.4.2.3.1.3 Immunity - The TED shall be immune to (i.e., its functionality not disturbed by):

a. Optical noise from fluorescent lighting, incandescent lighting, and display light output.

b. Electrical noise, transients, and radio frequency interference from the display, fluorescent lamps, other VSCS console and S/S equipment, or any other source.

c. Audible noise and vibrations from loud voices and equipment.

d. Sudden changes in temperature, humidity, or pressure within the control room area, including a force of air directed across the surface.

e. Smoke from any source.

f. Drifting of any display device relative to a collocated TED overlaying it.

g. Perspiration or corrosive moisture.

3.4.2.3.2 Communications Entry/Display Devices - The VSCS communications interactive entry/display devices shall be provided at all ATC positions within the sector suites, supervisory positions with access to VSCS A/G and G/G communications, and at administrative and ancillary positions with access to VSCS G/G communications.

3.4.2.3.2.1 Display Capability at an Operational Position - The display device shall be capable of concurrently displaying at least 12 radio frequencies, including emergency frequencies if assigned to the position, with their associated status and control areas. The display shall be capable of concurrently displaying the number of assigned DAs or a minimum of 25, whichever is less, DA status and control areas (with access to at least 50 DA status and control areas), the CA queue, and G/G communications feature control areas (e.g., HOLD, release, transfer). The display shall be visible under all ambient light conditions in the control room areas as defined in FAA-ER-130-005H-AP. The display device shall be a color device capable of displaying at least eight (8) colors simultaneously. The display device shall be capable of imparting coding information by means of color, size, shape, brightness, intensity, and blink of displayed areas, and change(s) thereto in any combination.

3.4.2.3.2.2 Communications Display Blink - If blink is used to impart status or other information, then the display devices shall provide for software selection and control of steady illumination or up to three distinct blink rates. The blink rates shall not vary with display screen intensity levels. The display devices shall be capable of providing concurrent blinking to multiple displayed areas. Blink rates shall be easily distinguished from one another, including when multiple rates are displayed simultaneously.

3.4.2.3.2.3 Communications Display Size - The VSCS communications interactive entry/display device shall have dimensions not exceeding those described in the VSCS-ACCC (Common Console) IRD.

3.4.2.3.3 IA Keypad Device - IA calls and IA control functions shall be accessible via an IA keypad device.

3.4.2.3.3.1 IA Keypad Pushbutton - The IA keypad device shall provide a telephone-type pushbutton, IA keypad with a 3 by 3 plus 1 numeric matrix with the zero digit centered on the bottom row and a call initiation pushbutton, a release pushbutton, and a backspace pushbutton for correcting erroneous entries. The call initiation and release pushbuttons shall be translucent and continuously transilluminated. The pushbuttons shall be transilluminated when the IA keypad is active for input. Distinct colors shall be used to indicate the functionality of the pushbuttons. A brightness control for the pushbutton backlighting shall be provided for the operator's use.

3.4.2.3.3.2 Alphanumeric Display - The IA keypad device shall have a built-in alphanumeric display suitable for providing visual feedback of number and function sequences input by the operator, and display of error and status messages. The alphanumeric display shall be visible under all ambient light conditions in the control room areas.

3.4.2.3.3.3 Installation - The IA keypad device shall be connected to a VSCS position via a twist-lock plug on a nonfouling connector cable having a minimum length of 24 inches. The alphanumeric display shall provide at least one row of at least 20 characters. The IA keypad device shall be designed such that it may be temporarily fixed in place at the position operator's discretion.

3.4.2.3.3.4 IA Keypad Construction - The IA keypad device shall be constructed to meet the environmental requirements as specified in 3.9.5 and the shock and vibration requirements as specified in 3.9.5.2.

3.4.2.3.4 Data Entry Devices - Data entry devices for supervisory, maintenance, and designated positions shall be a cathode-ray-tube/keyboard combination or equivalent. A cursor shall be provided on the display device to indicate the character space the next entry will affect. The data entry devices shall be capable of entering and displaying alphanumeric data for configuration map manipulations, status requests, and satisfying the data entry requirements of 3.5.4, System management functions.

3.4.2.3.4.1 Operator Review - Operator review of input data prior to entering the data into the system shall be provided.

3.4.2.3.4.2 Keyboard Configurations - Keyboard configurations, where used, shall conform to MIL-STD-1280.

3.4.2.3.5 Display Refresh - For display technologies requiring display area refresh, all VSCS displays shall be refreshed at a rate not less than 60 Hz. The maximum display load shall be displayed and refreshed without any decrease in brightness, and without any flicker. Automatic voltage or current controls, or both, shall be provided to maintain the size of the displayed area within 1% of its nominal size for all normal VSCS operating conditions. The display nominal size shall be defined in the human factors study and approved by the FAA.

3.4.2.3.6 Display Brightness - The brightness of any VSCS interactive displays device shall be adjustable across its range of brightness, with a minimum of 20 discrete steps, where the brightness ratio between any two adjacent steps is a constant, or continuously along an exponential curve connecting such discrete points. The minimum brightness setting shall be no brighter than that needed to maintain readability of the display under normal facility lighting conditions. The brightness control shall provide the capability for adjusting the display brightness over the full controllable range within 10 seconds by a single continuous touch action. This requirement shall not preclude the use of differing brightness or intensity levels within a display to convey status or other information. All VSCS displays shall have a contrast ratio of 8:1 or greater.

3.4.2.3.7 Feedback to Operators - The VSCS shall provide positive feedback to all operator actions as specified in Table III. Where visual or audible indications are not otherwise specified, the operator shall be provided messages, color changes, shape changes, brightness or intensity level changes, or other distinct indications confirming a requested system action, or indications that the action was not performed. If a TED is used, then the VSCS shall provide visual feedback to the position operator of valid touch detection, and of the displayed control area affected. The intent of visual feedback for touch detection is for the user to clearly distinguish between valid and invalid touches. If a TED is used then an operator-selectable (on/off) keyclick, indicating valid touch, shall be provided to the position operator's HS. Keyclick provided at a position shall not be transmitted over any A/G or G/G communications emanating from the position.

3.4.2.3.7.1 Function Timeouts - Where timeouts have been required in this specification, and for any other interactive operational sequences requiring two or more touch actions by a position operator to complete, then a timeout process shall be invoked after a system-level programmable time interval appropriate to the operational sequence (not greater than 30 seconds), if the operational sequence is not completed. The position operator shall be notified that such a timeout has occurred. In general, the timeout process shall effect a cancellation of the operational sequence.

3.4.2.3.7.2 RESERVED (See Addendum 1)

3.4.2.3.8 Operator Equipment

3.4.2.3.8.1 Headsets/Handsets and PTT Switches - Headsets/handsets and hand-held PTT switches shall be plug-compatible with existing ARTCC equipment, subject to FAA approval, and consistent with the Human Factors Design Requirements.

3.4.2.3.8.2 Loudspeakers - Each console position shall be provided two identical loudspeakers (LSs). These loudspeakers shall be as approved by the FAA. One LS shall be designated for A/G communications, the other for G/G communications. The loudspeakers shall be located a sufficient distance apart so that the source of audio from each is distinguishable to the operator. Facing the front of the console, the A/G speaker shall be on the right.

3.4.2.3.8.2.1 LS Volume Control - Volume control shall be provided for each loudspeaker. The volume control shall be located on or immediately adjacent to each LS. The volume control shall be as approved by the FAA.

3.4.2.3.8.3 Foot Switch - A foot activated switch shall be provided to perform the PTT function. The footswitch shall provide a Single Pole Single Throw (SPST) momentary contact.

3.4.2.3.8.4 Speech Intelligibility - Speech intelligibility of the VSCS shall meet the ANSI standard method of phonetically balanced monosyllabic word intelligibility, S3.2-1960, with a minimum score of 90%.

3.4.3 Special Entry/Display Controls

The VSCS entry/display function shall provide the air traffic controller position with special control capabilities to assist in managing the position communications. Special controls shall include, but not be limited to, the following.

3.4.3.1 RESERVED

3.4.3.2 Display Selection - Where two entry/display devices using identical technologies are provided at a common console, the entry/display function shall provide the position operator the capability to selectively alternate the two communications displays and functions between the two devices. The alternate selection shall be activated by entering an IA control code. Activation of the alternate display command shall cause the entry/display interactive control functions and images on one device to interchange with those on the other.

3.4.4 Ancillary Positions

The VSCS shall be capable of accommodating A/G and G/G communications at ancillary positions.

a. Area Manager
b. Traffic Management Unit
c. Weather Coordinator
d. Military Operations Specialist
e. Automation (Data Systems) Specialist
f. Central Weather Service Unit Meteorologist
g. Flight Data Communications Specialist
h. National Airspace System (NAS) Manager
i. Oceanic Display and Planning System (DAPS)
j. Airborne Warning and Control System (AWACS)
k. Aircraft Movement Information System Specialist
l. Area Supervisor
m. Maintenance
n. Enroute Monitoring

3.4.4.1 Ancillary Position Requirements - Ancillary positions shall be equipped with VSCS position equipment. Ancillary positions shall have the capability to access VSCS A/G and G/G communications. That access shall be classmarked pursuant to the needs and responsibilities associated with each ancillary position activity. Classmarked communications assignments for ancillary positions shall reside in area supervisory personnel and shall reside in position configuration maps as specified in 3.4.5, Supervisory Positions, and 3.5.4, System Management Functions.

3.4.4.2 Special Classmark Requirements - The capability shall be provided for one or more ancillary positions to be classmarked for transmitter/receiver main/standby selection on all frequencies available through the VSCS. The capability shall be provided for one or more ancillary positions to be classmarked for initiating a switchover from the A/G primary switch to the A/G backup switch, and for initiating a switchover from the A/G backup switch to the A/G primary switch.

3.4.4.3 RESERVED

3.4.5 Supervisory Positions

The VSCS shall provide for operational positions to be designated as area supervisory positions. Area supervisory positions shall have the same G/G communications capabilities as those provided to air traffic controller ATC operational positions. The area supervisor shall have supervisory monitoring capabilities and the capability to initiate VSCS communications reconfigurations within the supervisor's area of responsibility.

3.4.5.1 Supervisory Position Equipment - Each area supervisory position shall have VSCS C/C equipment. Each area supervisory position shall have a data entry device for systems management functions as specified in 3.5.4, System Management Functions.

3.4.5.2 Supervisory Functions - The area supervisor shall be provided with special functions that permit control and coordination of ATC positions and communications within a given purview. The special supervisory functions shall include, but not be limited to, those specified in the following paragraphs.

3.4.5.2.1 Supervisory Monitoring of ATC Positions - The supervisory positions shall be provided with the position voice-monitoring capabilities described in 3.3, Operational requirements, and 3.5.2.2.2.10.1, Monitoring.

3.4.5.2.2 RESERVED (See Addendum 1)

3.4.5.2.2.1 RESERVED (See Addendum 1)

3.4.5.2.3 RESERVED

3.4.5.2.4 RESERVED

3.4.5.3 Supervisory Control of Position Reconfiguration - The area supervisory position shall be provided with the capability to initiate VSCS communications reconfiguration for ATC positions within the supervisor's designated area of responsibility. The area supervisory position operator shall have the capability to make temporary modifications to assignments and classmarks in position maps for operational ATC positions for contingency purposes. Such temporary modifications shall be in effect until modified again, or until any reconfiguration of the affected position is implemented.

3.4.5.4 RESERVED

3.4.6 Local Maintenance Position

The VSCS shall provide for one operational position to be designated as the facility local maintenance position. It shall be provided with A/G and G/G communications capability and, in addition, shall have the capability to request, control, display, store, and transfer on-site system tests and test results. All built-in test equipment (BITE) and built-in tests (BITs) shall be accessible from the VSCS local maintenance position. Distribution and protector frames shall be in close proximity to the maintenance position. Patching facilities shall be accessible from the local maintenance position.

3.4.6.1 RESERVED (See Addendum 1)

3.4.6.1.1 Local Maintenance Position Features - The VSCS shall provide a means to read and store the results of built-in test sequences (BITS), prepare and run extended sequences of parametric tests, select positions or whole sector suites to test/validate the equipment functionality (entry/ display, switching/control, special features), select and connect lines/trunks to perform line service verification, loop maintenance tests, and switching system performance tests. Built-in test equipment (BITE) shall be used to support BITS, parametric tests, and automated test sequences set by the local maintenance position operator.

3.4.6.1.2 Test Panel - A test panel shall be provided at the local maintenance position for monitoring and electronically patching IP lines, trunks, A/G, PABX, and all internal and external data communication interfaces and circuits for maintenance access. The test panel shall provide a means for monitoring all outgoing and incoming IP lines, trunks, and circuits. The test panel shall provide a means for connecting to either the line or equipment side of a circuit for test and for isolating a circuit from an external interface for testing. Non-transparent tests on operating VSCS equipment shall be initiated only after confirmation that the equipment is in a standby state, and that such tests will not affect the continued functioning of any operational positions. After the completion of such tests, the tested equipment, on command or after a preprogrammed time interval, shall revert from the standby state to an active or ready-for-use state. The test panel shall be arranged to:

a. Make busy tests.
b. Establish an out-of-service condition on a circuit or IP trunk.
c. Talk, monitor, and originate outgoing or incoming calls for testing trunks.
d. Test switching equipment.
e. Test interswitch trunks.
f. Access the line side of all circuits.

3.4.6.2 Local Maintenance Theory of Operation - The local maintenance position shall augment the VSCS BITS/BITE to provide a comprehensive automated maintenance workstation. It shall provide the software and hardware tools required to meet the operations and maintenance criteria necessary to make possible the availability, grade of service, and reliability set forth as requirements in this document. Implementation and operability shall follow methods that are well established in commercial industry applications of automated test equipment, using standard test equipment data busing and measurement techniques (IEEE-488, and current Bell System Technical References (BSTRs)).

3.4.6.3 RESERVED (See Addendum 1)

3.4.6.3.1 RESERVED (See Addendum 1)

3.4.7 Data Entry Position

The VSCS shall provide for at least one position to be designated as a data entry position that has the capability to access the VSCS configuration database, VSCS performance data, and system communication status data. Data entry position access to the VSCS database shall not perturb or impede the real-time data and communications processing requirements of the VSCS. The data entry position shall be assignable to an appropriately equipped position.

3.4.7.1 Data Entry Position Equipment - The data entry position shall be provided with a data entry device, a hardcopy printer device, and access to a mass storage media meeting the requirements of 3.5.4, System management functions.

3.4.7.2 Data Entry Position Software - Software shall be provided to enable a data entry position to access and manipulate the VSCS configuration data base. Access to the VSCS internal data shall be through an interactive computer-human interface approved by the FAA and described and documented in the Human Factors Design Document.

3.4.8 Reconfiguration Command Entry and Display

The VSCS entry/display function shall support reconfiguration to all levels specified in 3.5.4.1.1.3, Reconfiguration levels. The entry/display function shall accept position configuration map data from the control function and shall display implemented map data as directed by the control function. The VSCS shall accept reconfiguration commands from designated supervisory positions, and the local maintenance position only. Each position with reconfiguration authority shall have the scope of its reconfiguration authority defined by classmark. Authorized personnel shall be able to initiate a reconfiguration of the VSCS by entering the reconfiguration command and logical configuration group or position map(s) to be implemented.

3.4.8.1 Configuration Map Access - The entry/display function shall provide authorized personnel access to the VSCS configuration database via the control function. Access to the configuration database shall be provided for, but not limited to, the following requirements.

3.4.8.1.1 Hardcopy Listings of Configuration Maps - The entry/display function shall provide for formatted print output of configuration maps. The printed reports shall show all functional capabilities, restrictions, and assignments for each operational position within the VSCS. Hardcopy output shall be provided upon receipt of a command from classmarked positions.

3.4.8.1.2 Reconfiguration Status Reporting - Reconfiguration status reports shall be made available upon request to the initiator of the reconfiguration, to area supervisors affected by the reconfiguration on visual display, and to other authorized personnel. Status reports shall be provided upon receipt of a command from a classmarked position.

3.4.8.1.3 Limitations of Reconfiguration - Except where otherwise specified, reconfiguration processing at an operational position shall not modify previously selected display brightness and audio levels, nor change HS or LS selections, M/S TX/RX selections, BUEC selections or other selections normally controlled by the position operator.

3.4.8.1.3.1 RESERVED (See Addendum 1)

3.4.8.1.3.2 RESERVED (See Addendum 1)

3.4.8.1.3.3 RESERVED (See Addendum 1)

3.4.8.1.3.4 RESERVED (See Addendum 1)

3.4.8.1.3.5 RESERVED (See Addendum 2)

3.4.8.1.3.6 RESERVED (See Addendum 2)

3.4.8.1.3.7 RESERVED (See Addendum 1)

3.4.9 Entry/Display Function Hardware

3.4.9.1 Scope of Entry/Display Function Hardware - The entry/display function hardware shall consist of the following items:

a. Communications control interactive display devices.
b. Data entry devices.
c. IA keypad entry and display devices.
d. Position loudspeaker(s).
e. Supervisory position voice recording and playback devices.

3.4.9.2 VSCS Console Equipment - The VSCS entry/display function console equipment shall include:

a. Two loudspeakers with associated volume controls.

b. Two dual jack modules.

c. Chime with associated volume and on/off control.

d. Display panel(s) supporting A/G communications control functions, G/G communications control functions, or special control functions, or any combination thereof.

e. Entry device for each display panel.

f. Separate IA keypad device.

g. All hardware and associated electronics for the above devices.

3.4.9.2.1 Position Headset/Handset/PTT Jacks - The VSCS shall provide two dual jack modules for each common console. Each jack module shall be capable of accommodating any combination of two headsets or handsets and their associated PTT switches. One jack on each jack module shall provide PTT preemption capabilities. The second jack shall be preemptable. The functionality of the two jack modules shall be in accordance with CTA-211-V-0208-91, Interaction of the Dual Jack Modules. The jack power and jack module shall be compatible with headsets/handsets as specified in 3.4.2.3.8.1. Each jack (total of four) shall be supplied with its own volume control capable of adjusting the audio output level over a range of +5 dB to -27 dB of the nominal level. Limiting shall be such that no signal greater than -20 dBm shall be allowed to the headset, regardless of the volume control setting. The volume controls shall be as specified in NAS-IR-21014201 (Part 2) VSCS to ACCC (Common Console) IRD.

3.4.9.2.1.1 RESERVED (See Addendum 1)

3.4.9.2.2 RESERVED

3.4.9.2.3 Jack Preemption - A PTT action by a position operator plugged into either preempting jack shall cause the termination of any transmission in progress by a position operator plugged into either preemptable jack. The preempted position operator shall be provided the preempting voice, but shall not receive sidetone of his own voice for the duration of the preemption.

3.4.9.3 Display Function Equipment

3.4.9.3.1 Communications Control Display Devices - Console display interactive devices shall conform to the requirements specified in 3.4.2.

3.4.9.3.2 Touch Entry Devices - Common console TEDs shall conform to the requirements specified in 3.4.2.

3.4.9.3.3 IA Keypad Entry and Display Devices - Console IA keypad entry and display devices shall conform to the requirements specified in 3.4.2.

3.4.9.3.4 Position Loudspeakers - Two loudspeakers shall be provided for console equipment. One LS shall be used for G/G voice reception when selected by the position operator. The other shall be used for A/G voice reception at positions with A/G communications capability and when selected by the position operator. The operating controls and indicators for the chime device referred to in paragraph 3.4.9.3.5 shall be collocated with the position G/G loudspeaker.

3.4.9.3.4.1 LS Volume Controls - LS volume controls shall be located on or immediately adjacent to their affected LS. The range of control shall be such that with the volume control in the maximum volume position the output shall not exceed the power rating of the LS, and in the minimum volume position, the audio output of the LS shall be discernible. The physical device used for volume control shall be as specified in the VSCS-ACCC (Common Console) IRD.

3.4.9.3.4.2 RESERVED (See Addendum 1)

3.4.9.3.4.3 LS Performance - In this specification, the term “loudspeaker” shall mean off-the-shelf raw loudspeaker unit, the loudspeaker enclosure, any associated circuitry, and any internal acoustical absorbent material. Loudspeakers shall have a nominal input rating of 8 ± ¾ ohms impedance, 5 watt input power. The loudspeaker when driven by VSCS shall meet the speech intelligibility measurement requirements of 3.4.2.3.8.4 at one-half the full volume setting. Loudspeaker grill material shall be of an acoustically transparent material.

3.4.9.3.5 Chimes - A chime device shall be provided for each VSCS common console to alert the operator to incoming G/G communications. The chime device shall be capable of generating five distinct chime tones. The device shall provide selectability of a tone for a given console position by facility maintenance personnel; the console position operator shall not be allowed the capability of changing the tone. The chime device audio shall be available to the position operator through the position G/G loudspeaker.

3.4.9.3.5.1 Chime Volume - A combination on/off switch and volume control and a visual on/off status indicator shall be collocated with the chime device. The chime volume control and the LS volume control shall be coupled in such a way that the chime volume remains discernibly below the LS volume when the LS volume control is adjusted up or down. Adjustments to the chime volume control shall not couple to the LS and shall permit adjustment of the chime volume additionally lower than LS volume.

3.4.10 Location of Console Equipment

The VSCS console equipment shall be located within and on the S/S common console in accordance with the VSCS-ACCC (Common Console) IRD (See 3.6.2).

3.4.11 C/C Equipment Power

Electrical power supplies for VSCS console equipment shall be provided so that the loss of power at any one common console shall not affect the power available at or to any other common console. The power required for all VSCS console equipment at a position shall not exceed 510 Watts.

3.5 SWITCHING AND CONTROL FUNCTIONS

The switching and control functions shall provide all voice interconnections between positions in a facility, between positions at a facility and positions at other facilities, and between designated A/G positions and the radio and BUEC interfaces. The switching and control functions shall provide interface control signaling between the display function and all switching interfaces to implement connections initiated either by position operators or from switching interfaces. The control mechanisms required to establish, control, monitor, and disconnect communications shall be provided. Special features, as specified in 3.3 and 3.4, shall be provided and shall include, but not be limited to, the following:

a. IC (DA and IA).
b. IP (DA and IA).
c. A/G communications.
d. Conferencing.
e. Call forwarding.
f. RESERVED.
g. OVR.

Maintenance and system management functions shall be provided by the switching and control functions and shall include, but not be limited to, the following:

a. Real-time quality control (RTQC).
b. Reconfiguration.
c. Reconfiguration database management.
d. Traffic data collection.
e. System timing.

3.5.1 Design Considerations

3.5.1.1 Modularity - The switching and control functions shall be modular in construction to meet the size and expansion requirements specified in 3.2. The switching and control functions shall be designed to handle the traffic loads as specified in Tables II and III.

3.5.1.2 Program Control - The switching and control functions shall be under stored program control.

3.5.1.3 Technology Utilization - The design of the switching and control functions shall use cost-effective applications of proven hardware, software, and firmware technology. Main switching elements shall not use electromechanical relays. Software/firmware shall be prepared in accordance with 3.10.

3.5.1.4 RESERVED (See Addendum 1)

3.5.1.5 RESERVED (See Addendum 1)

3.5.2 Switching and Control Functional Requirements

3.5.2.1 A/G Communications

3.5.2.1.1 A/G Special Features

3.5.2.1.1.1 Assigned Frequencies - Operational positions shall access A/G capabilities through radio or BUEC interfaces. The frequency assignments shall be defined in the position configuration map(s). The capability shall be provided to assign access for up to 24 unique frequencies to any operational position. The VSCS design shall not require emergency frequencies to be assigned to an operational position. A facility VSCS shall be capable of simultaneous A/G connectivities, at a minimum, as indicated in Table XI. Any assigned frequency at an operational position is capable of being activated through selection for transmission, reception, or both.

3.5.2.1.1.2 Fan-in Feature - The switching and control functions shall be capable of receiving A/G voice from any radio or BUEC interface and providing it and associated signaling to up to 12 positions that have been assigned access to that interface. The number of positions capable of being simultaneously assigned to radio or BUEC interfaces shall be, at a minimum, as specified in Table XII. There shall be no degradation in signaling time or in voice quality at any of the multiple positions as a result of this fan-in feature.

Table XI. A/G Connectivity

Percentage of All Positions	Number of Connectivities Assigned to a Position at One Time
40	0
20	4
13	6
14	10
9	14
3	18
1	24

Note: The number of positions shall be the integer greater than or equal to the product of the percentage and the number of positions in the facility.

Table XII. A/G Fan-in and Fan-out

Percentage of all Interfaces	Number of Positions Assigned with the Fan-in Feature	Number of Positions Assigned with the Fan-out Feature
60	6	6
40	12	12

Note:

(1) The number of interfaces shall be the integer greater than or equal to the product of the percentage and the number of A/G interfaces in the facility.

(2) This table does not include interfaces for emergency or tactical frequencies where the 12 positions per interface shall always be available.

3.5.2.1.1.2.1 Emergency Frequency Fan-in - All A/G positions shall be capable of receiving A/G voice from radio interfaces for the emergency frequencies of 121.500 MHz and 243.0 MHz. Fan-in of voice and signaling shall be provided only to those positions assigned access to each radio interface.

3.5.2.1.1.3 Fan-out Feature - The switching and control functions shall be capable of managing access to the radio interface or the BUEC interface from up to 12 assigned positions to any given interface so that only one position is capable of transmission on the interface at any one time. All positions with that frequency assignment shall receive transmission status signals. The number of positions capable of being simultaneously assigned to A/G interfaces shall be, at a minimum, as specified in Table XII. There shall be no degradation in signaling time or in voice quality as a result of this fan-out feature.

3.5.2.1.1.3.1 Emergency Frequency Fan-out - All A/G positions shall be capable of transmission using radio interfaces for the emergency frequencies of 121.500 MHz and 243.0 MHz. The fan-out features shall be provided only for those positions assigned to each radio interface.

3.5.2.1.1.4 Multiple Locations of a Frequency - For each frequency through the VSCS, a capability shall be provided to assign A/G operational positions access to multiple radio interfaces and BUEC interfaces. The VSCS shall be capable of providing independent voice and control to assigned operational positions, except as required by 3.3.1, A/G communications. This independence shall result in a frequency being assigned multiple times, with each frequency functioning as a distinct frequency.

3.5.2.1.1.5 RESERVED (See Addendum 2)

3.5.2.1.1.6 RESERVED

3.5.2.1.1.7 PTT Lockout - The VSCS shall provide PTT lockout capability to restrict transmission to a single user at a time at each radio or BUEC interface. The capability to lock out other attempted transmissions shall exist for the duration of the PTT that caused the initiation of the lockout capability.

3.5.2.1.1.7.1 Radio Interface PTT Trunk Lockout Signal - Upon recognizing a PTT trunk lockout signal from a radio interface that provides a PTT trunk lockout signal, the VSCS shall enable a PTT lockout capability to all operational positions assigned access to transmission on the radio interface through the fan-out feature.

3.5.2.1.1.7.2 PTT Lockout for Multiple Assignments of a Frequency - When PTT is actuated at a position for a frequency selected for transmission, a PTT lockout function shall be activated within the VSCS to inhibit any other attempted transmissions on the affected frequency as defined by the fan-out feature to the radio interface or BUEC interface for that frequency.

3.5.2.1.1.8 Preemption

3.5.2.1.1.8.1 Position Jack Preemption - Position jack preemption shall be provided through the jack modules described in 3.4.9, Entry/Display Function Hardware.

3.5.2.1.1.8.2 PTT Preemption - For PTT preemption as specified in 3.3, the switching function shall establish the preemptor for voice transmission and PTT signaling. The preempted position shall be provided an alert indicating preemption and shall be provided signaling and voice to monitor the preempting transmissions on that frequency. The PTT preemption capability shall be contained in the position map(s). No more than one position shall be capable of preempting other positions that have been assigned access to the same radio interface or BUEC interface through the fan-out feature.

3.5.2.1.1.8.3 RESERVED

3.5.2.1.1.8.4 RESERVED (See Addendum 2)

3.5.2.1.2 A/G Using Radio Interface

3.5.2.1.2.1 Configuration for A/G - The VSCS configuration data shall contain a list of all VSCS ports used to access the radio interfaces.

The VSCS shall be capable of establishing the M/S selection and receiver remote muting status to be in agreement with the last operational configuration.

3.5.2.1.2.1.1 Configuration for Radio Interfaces - The VSCS shall be capable of storing data information on the radio interfaces configuration that shall include, but not be limited to:

a. Frequencies.

b. Sites for each frequency with transmission and reception collocated; otherwise, sites for transmission and sites for reception for each frequency.

c. Existing Radio Interface module to access from the VSCS for each frequency site.

d. Frequency selective or split mode operation.

The VSCS shall be capable of modifying the on-line radio interfaces configuration within the VSCS without disturbing calls in progress or losing incoming communications.

3.5.2.1.2.1.2 RESERVED

3.5.2.1.2.2 Frequency Selection - The switching function shall recognize a request for a frequency selection from an operational position that has the frequency assigned. The VSCS shall then enable the established voice and signaling communication paths to the radio interface providing the operational configuration for the interface has not been assigned to BUEC, and shall enable the recognition of position requests for:

a. Enabling/disabling transmission.
b. Enabling/disabling reception of voice.
c. M/S selection.
d. Remote receiver muting control and local position muting.
e. PTT keying.

The position requesting frequency selection shall be provided a frequency selection confirmation from the switching function that shall include the operational status of the M/S control for transmission and reception and remote receiver muting control.

3.5.2.1.2.2.1 Frequency Deselection - The switching and control functions shall recognize a request for a frequency deselection for a radio interface at an operational position that has the frequency selected. Deselection shall result in the following:

a. Voice shall neither be provided to the radio interface nor to the position from the radio interface.

b. Only the request for frequency selection shall be recognized from the operational position for the radio interface.

c. The operational position shall continue to receive signaling associated with the fan-in and fan-out features.

3.5.2.1.2.3 PTT and Voice Transmission - VSCS transmission over a frequency shall be controlled by PTT keying at an operational position with the frequency selected for transmission. The VSCS shall provide PTT signaling at the radio interface for the frequency while PTT is engaged. The VSCS shall inhibit simultaneous PTT keying on each frequency interface. The switching function shall provide PTT signaling to the radio interface when PTT on a frequency is recognized, shall provide voice transmission, and, shall expect PTT confirmation from radio interfaces that provide PTT confirmation. The VSCS shall recognize a continuous PTT confirmation from the radio interface while receiving the radio interface PTT confirmation signal. The switching function shall provide the PTT confirmation to the originator of the PTT, shall enable a PTT lockout capability to all other positions that have selected the frequency, and shall provide a squelch break signal, or equivalent, to all positions that have the frequency assigned that shall indicate that voice transmission is occurring. An alert shall be provided to the maintenance position when PTT confirmation is expected but is not received from the radio interface.

When PTT is released, appropriate signaling, control, and status shall be similarly distributed to the radio interface and to all positions with the Frequency assigned.

3.5.2.1.2.3.1 PTT for Selective Frequency Operations - When two frequencies are in the selective mode and a PTT signal is activated on one of the two frequencies, both frequencies shall be locked out to PTT at all other positions with those frequencies selected.

3.5.2.1.2.3.2 PTT for Split Operations - When a frequency is operating in the split mode and a PTT signal is activated at a position for that selected frequency, only that frequency is locked out to PTT at other positions with that frequency selected.

3.5.2.1.2.3.3 Multiple Transmission at a Position - When more than one frequency has been selected at a position and more than one frequency has its transmission capability enabled and the PTT is keyed at the position, the switching function shall provide PTT signaling and voice for each frequency to the radio interface or BUEC interface, whichever is enabled on each frequency. The VSCS shall be capable of concurrent transmissions from a position for the number of frequencies specified in 3.5.2.1.1, A/G Special Features.

3.5.2.1.2.3.4 PTT Receiver Muting - When PTT is active at the radio interface or BUEC interface, the switching function shall completely mute the received radio voice, for the active channel, at the radio interface. If a PTT Trunk Lockout signal is received from a radio interface that provides the PTT trunk lockout signal while PTT is active, the switching function shall enable the received radio voice path.

3.5.2.1.2.4 A/G Voice Reception - The switching function shall recognize a squelch break signal from a radio interface that provides a squelch break and shall provide that signal to all positions that have the frequency assigned. For BUEC interfaces, the VSCS shall recognize voice signals from the interface as squelch break and shall internally generate the squelch break signal. The presence of the squelch break signal is to indicate that the receiver has been activated and is receiving a radio signal.

3.5.2.1.2.4.1 Multiple Receptions at a Position - When more than one frequency has been selected at a position and more than one frequency has its voice reception capability enabled, and multiple voice receptions occur simultaneously for any of those frequencies, the switching function shall provide the signaling and voice for each frequency to the position from either the radio interface or the BUEC interface, whichever is enabled on each frequency. The VSCS shall be capable of receiving voice concurrently at a position for the number of frequencies specified in 3.5.2.1.1, A/G Special Features.

3.5.2.1.2.5 Activation of Radio Interface Control Changes - When a frequency has been selected at a position, the switching function shall recognize requests for change in state for M/S control and receiver remote muting. After a request for a change in state is recognized, the switching function shall apply the proper signaling at the radio interface. Upon confirmation of the change in state from the radio interface the switching function shall provide a confirmation signal of the change to all positions that are assigned the frequency. For all interfaces, the position visual indications shall provide status in accordance with 3.3, Operational Requirements.

3.5.2.1.2.6 Enabling/Disabling Transmission/Reception - When a frequency has been selected at a position, the switching function shall recognize requests for enabling or disabling transmission or reception for that frequency from the position and shall implement the request and provide an indication to the position.

3.5.2.1.3 A/G Using BUEC - The VSCS shall be capable of accessing the tunable BUEC transceivers via the appropriate BUEC system, as described in the VSCS-BUEC IRD (See 3.6.6).

3.5.2.1.3.1 BUEC Interface Configuration - The VSCS configuration database shall contain frequencies and corresponding assigned BUEC access ports and shall contain the operational positions that shall be capable of selecting the BUEC for each frequency.

3.5.2.1.3.2 BUEC Selection and Signaling

3.5.2.1.3.2.1 Request Selection - The switching function shall recognize a request for a BUEC frequency access from an operational position that has the frequency selected and BUEC access permitted, which shall enable both transmission and reception of voice. The switching function shall store the operational configuration of the radio interface selections for each position assigned the frequency and shall disable PTT to the radio interface for the frequency. The VSCS shall then enable voice and signaling to the assigned BUEC access port from all positions with the frequency selected. The switching function shall recognize a BUEC SELECT signal from the position and shall deliver it to the assigned port. An alert shall be provided to the maintenance and NAS Manager positions when a priority module or malfunction indication is expected, but is not received within 10 seconds.

3.5.2.1.3.2.2 Malfunction Indication - Upon receiving the malfunction indication, MALF, from the BUEC interface, all positions with the frequency selected and the area supervisory position shall receive an alarm to indicate the BUEC access malfunction. The switching function shall automatically assume a BUEC deselection.

3.5.2.1.3.2.3 Priority Indication - Upon determination of the BUEC priority module accessed, all positions with that frequency selected shall be provided with the priority module number, and the switching function shall be enabled for recognition of position requests for:

a. PTT keying.
b. BUEC deselection.

3.5.2.1.3.2.4 Request Deselection - Upon recognizing a BUEC deselection request, a control signal shall be provided to the assigned port for the frequency to effect deselection. PTT signaling shall be disabled from BUEC. The switching function shall then reestablish the most recent operational configuration of transmission and reception with the A/G interface for each assigned position's previously stored selections.

3.5.2.1.3.2.5 Voice Communications Interface - The voice communications and signaling shall be as described in the VSCS-BUEC IRD (See 3.6.6).

3.5.2.1.3.2.6 Command and Status Signal Interface - The command and status signals at the BUEC interface shall be as described in the VSCS-BUEC IRD (see 3.6.6).

3.5.2.1.3.3 PTT and Voice Transmission - VSCS transmission over a frequency shall be controlled by PTT keying at an operational position with the frequency selected for BUEC transmission. The VSCS shall provide PTT signaling at the BUEC interface for the frequency while PTT is engaged. The VSCS shall use the PTT lockout function to inhibit simultaneous keying of a frequency. The switching function shall provide PTT signaling to the BUEC interface when PTT on a frequency is recognized and shall provide voice transmission. The switching function shall provide an indication that PTT has reached the priority module interface to all positions with the Frequency assigned and shall activate a PTT lockout capability to all positions that have selected the frequency except the position activating PTT. When PTT is released, appropriate signaling, control, and status indications shall be similarly provided.

3.5.2.1.3.3.1 PTT Signal Interface - The PTT signal shall be as described in the VSCS-BUEC IRD (See 3.6.6).

3.5.2.1.3.4 BUEC Voice Reception - Voice reception signals and control shall be as specified in the VSCS-BUEC IRD (see 3.6.6). The VSCS shall recognize voice signals from the BUEC interface as a squelch break. The switching function shall provide voice to all positions that have the frequency selected.

3.5.2.1.4 A/G Backup Switch Operation - The VSCS shall include a physically separate A/G backup switch to ensure the availability of all of the VSCS A/G communication functions. When the A/G backup switch is used, it shall assume all A/G switching functions previously handled by the A/G primary switch. The A/G backup switch shall provide the same signaling and communication connectivity from the operational position to A/G and BUEC interfaces as does the A/G primary switch, but using separate paths.

3.5.2.1.4.1 Hot Backup - The A/G backup switch shall be a hot backup; that is, it shall be up and available to replace the A/G primary switch in case of degraded operation in the primary switching function. The A/G backup switching function shall be configured with the same map or the same maps that configure the A/G primary switching function. The A/G primary and A/G backup switches shall maintain synchronous and identical A/G operational configurations. The A/G primary and A/G backup switches shall be designed such that the failures or effects of failures in either switch cannot propagate to the other switch. The A/G backup switching function shall periodically run its self-diagnostics and report its status.

3.5.2.1.4.2 Total Switchover - The A/G backup switch shall be switched into operation as a complete function; the A/G backup switching function shall not be switched into the A/G communication path for individual channels.

3.5.2.1.4.3 A/G Backup Switch Switchover Threshold - The A/G communication shall be switched to the A/G backup switch when an A/G primary switch failure has been detected. The A/G backup switch failure and switchover to primary switch threshold shall be the same threshold as that for the primary switch. An A/G switch failure shall be defined to exist when 10% or more of the assigned frequencies within a facility are not operational within the switching and control functions. The switchover to the A/G backup switch shall not affect the G/G configuration or operations.

3.5.2.1.4.4 A/G Backup Switch Manual Recovery - After a failure of the operational A/G switch, return to that A/G switch shall be manually controlled by the maintenance and NAS Manager positions. In the event that both of the A/G primary switch and the A/G backup switch exceed preestablished failure thresholds, manual control of the switchover process shall be provided at the maintenance and NAS Manager positions.

3.5.2.2 G/G Communications - The switching and control functions shall provide all call processing including control and supervisory signaling and voice connectivity for all IC and IP calls to and from any active VSCS G/G interactive display panel. The switching and control functions shall provide call processing for all VSCS switching features and also for all calls requiring trunk access to positions or services external to the VSCS.

3.5.2.2.1 Call Processing - The switching and control functions shall include, but not be limited to, the following program controlled capabilities:

a. Recognize a call request and provide dial tone if applicable.
b. Recognize calling source.
c. Recognize type of call requested (DA, IA, conference, etc.).

    1. Look up called number.
    2. Process dialed number.

d. Determine and select path to called source.
e. Test path availability.
f. Test path continuity.
g. Verify absence of foreign potentials.
h. Signal called source.

i. Monitor status of call.
j. Provide applicable signaling information of status of call to calling and called parties.

1. Ring back.
2. Ringing.
3. Tones.

k. Take down path when there is a disconnect by appropriate party.

3.5.2.2.2 VSCS Switch Features - The switching and control functions shall include, but not be limited to, the following VSCS features:

a. Calling source identification.
b. Direct access.
c. Direct access with override.
d. Indirect access.
e. Indirect access with override.
f. Conferencing.
g. Voice call.
h. Call forwarding.
i. RESERVED.
j. Call hold.
k. Voice routing.

3.5.2.2.2.1 Calling Source Identification - The switching and control functions shall identify the calling source to the called party when both are using interactive display panels terminated on a VSCS. The switching and control functions shall identify the trunk on incoming non-VSCS originated calls. For VSCS-to-VSCS calls, and wherever else possible, the VSCS shall translate the numbering plan's calling number to an alphanumeric calling party designator and shall provide that designator to the display function.

3.5.2.2.2.2 DA Calls - The switching and control functions shall provide connectivity from the display function for DA (both IC and IP) calls by converting the call processing address digits of the desired destination into the appropriate connections. The call processing sent to the called party shall include call feature information. Except for incoming OVR calls and calls in HOLD, DA call selection shall release the position from a previous IC or IP call and establish a DA path to the new position.

3.5.2.2.2.2.1 Calling Party DA - For a DA call, DA actuation at the position shall cause switch connectivity to be established to the called position. For an IP DA call, DA actuation at the position shall initiate the seizure of the appropriate trunk. A ringback tone signal shall be furnished to the calling position except for voice calls or OVR. A signal shall be sent to sound the chime at the called position.

3.5.2.2.2.2.2 Called Party DA - When the called party answers, the ringback tone to the calling position shall cease, and the communication link shall be completed.

3.5.2.2.2.2.3 DA Release - The communication link shall be continuously monitored by the switching and control functions and shall be disconnected when either party initiates a call disconnection.

3.5.2.2.2.3 IA Calls - The switching function shall provide IA call connectivity by converting the number of the destination into the appropriate connections. IA call processing shall include line and trunk signaling required to establish the circuit and identify the calling party position, the call type (IC or IP), call mode (DA, IA, OVR, or voice) and to invoke the requested call feature.

3.5.2.2.2.3.1 RESERVED (See Addendum 1)

3.5.2.2.2.3.2 Called Party CA - The IA call shall be directed to the CA queue of the called position if the position does not have a corresponding DA touch area for answering the call (where answering is required). The ringback tone shall cease when the call is answered.

3.5.2.2.2.3.3 Called Party CA Busy - When four calls are in the queue, or when three calls are in the queue and there is an active CA call at the called position, a busy tone shall be sent to the current calling position.

3.5.2.2.2.3.4 CA Answer - When a call in the CA queue is selected for answering, as specified in 3.3.2, G/G Communications, the voice connectivity shall be established.

3.5.2.2.2.3.5 Calling Party Queue Release - Release of an IA call by the calling party shall cause the indication of that call to be cleared from the called party CA queue and the communication path to be disconnected. No other calls in the queue shall be affected. Any CA calls released by the calling party shall cause the disconnection of the communication path from that calling party only.

3.5.2.2.2.3.6 IA Release - An actuation of the CA feature at the called position shall release any active call. Alternative methods for release shall be by initiating or answering any other IC or IP call. If the IA control is pushed to release from an IA call, the call shall be released. Another operation of the IA pushbutton shall be required if another IA call is to be made.

3.5.2.2.2.4 RESERVED (See Addendum 1)

3**.5.2.2.2.4.1 OVR Signaling -** After the connection has been made, an audible signal shall be provided to both the calling and called positions to indicate that the OVR connection is complete. The audible signal shall be a 0.2 second burst of dial tone (zip tone) for the first incoming OVR at the called position. A distinct, modified dial tone shall be the audible signal when the called position already has at least one incoming OVR connection and the incoming OVR is the second or subsequent simultaneous OVR. When the simultaneous OVR conference limit has been exceeded, a third distinct, modified dial tone shall be used to indicate each subsequent incoming two-party OVR call.

3.5.2.2.2.4.2 Calling Party DA OVR - When a DA assigned the OVR feature is actuated, the connectivity to the called position shall be established by the switching and control functions. When the DA is classmarked to require G/G PTT, the position shall continue to use PTT with the overridden position even after being itself overridden by a third position.

3.5.2.2.2.4.3 Calling Party IA OVR - IA OVR calls shall originate from any position having IA OVR capability as permitted by classmarks. Upon selection of an IA at a position and the receipt of a dial tone from the switching function, the dialing of a special OVR code and the desired position number, the voice connection between the calling and the called positions shall be established by the switching and control functions.

3.5.2.2.2.4.4 Called Party - No action shall be required by the called party to complete the connection for an OVR call. The switching function shall provide the capability for the calling party to join in ongoing G/G calls at the called position, subject to available OVR conference resources. OVR calls shall not be transmitted over A/G.

3.5.2.2.2.4.5 Initiating Calls During an OVR - The switching and control functions shall provide the necessary capability such that the receipt of an OVR call at a position shall not inhibit the position from placing an IC, IP, or A/G call while being overridden.

3.5.2.2.2.4.6 RESERVED (See Addendum 1)

3.5.2.2.2.4.7 RESERVED (See Addendum 1)

3.5.2.2.2.4.8 Extended OVR Capability - When a simultaneous OVR conference call has reached the OVR conference size limit, further attempts to override any of the participants in the OVR conference shall not be blocked, but shall be established from the overriding position to the overridden position as a two-party OVR call. As each simultaneous OVR conference call reaches the simultaneous OVR limit, an alert indicating that an OVR conference resource is not available shall be sent to the maintenance and NAS Manager position as designated.

3.5.2.2.2.4.9 OVR Release - When the calling party disconnects from an OVR call, the switching and control functions shall take down and release all resources used for that call.

3.5.2.2.2.4.10 RESERVED (See Addendum 1)

3.5.2.2.2.5 Conferencing - The switching and control functions shall provide resources for and establish conferences initiated through DA or IA activation at the display function. The conferencing capability shall include access to IC and IP conferees. Conferencing capability shall provide for conference sizes of up to 10 simultaneous conferees. The number of simultaneous conferences capable shall be at least 16. Conference calls shall not be limited by the number of OVR calls or voice calls within the VSCS.

3.5.2.2.2.5.1 Meet-me Conference - The switching and control functions shall provide an internal bridge, or equivalent, and resources to establish simultaneous meet-me conferences.

3.5.2.2.2.5.2 Progressive Conference - The switching and control functions shall provide the internal signaling and resources to establish progressive conferencing by adding positions to the conference as they are identified and connected.

3.5.2.2.2.5.3 RESERVED (See Addendum 2)

3.5.2.2.2.6 Voice Call - The switching and control functions shall provide positions with the capability to activate or join a voice call to positions at another facility or to positions at more than one facility over multipoint IP trunk circuits. The maximum number of positions capable of simultaneously accessing an outgoing voice call trunk shall not exceed five at any facility. Incoming IP voice calls shall be assignable to positions or group of positions within a facility. A capability shall exist within the VSCS for at least 100 voice call trunks.

3.5.2.2.2.6.1 Voice Call, Calling Position - Selection of a DA voice call circuit at a position shall initiate call processing to connect with the selected trunk and to signal all other positions that can access that trunk that it is in use. The original DA voice call selection shall complete the voice call circuit permitting voice paging of the desired positions at the called facility. Positions within a VSCS, to the voice call limit, shall be capable of joining the busy voice trunk on a conferencing basis by selection of the appropriate DA control. The sixth position attempting to join the voice call shall receive a busy signal.

3.5.2.2.2.6.2 Voice Call, Called Position - When the voice call is answered by operation of any DA voice call control for that circuit, the applicable switching and control functions shall signal all positions served by the voice circuit that the call has been answered. Connectivity shall be established by the switching function only to the answering position. Any position with DA access to this busy trunk shall be capable of joining on a conferencing basis.

3.5.2.2.2.6.3 Voice Call, IA - The capability shall be provided to dial-up through IA any voice call circuit available to the VSCS. Accessing the voice call circuit by IA selection shall initiate all appropriate signaling as for DA selection. If the IA call attempts a call on a busy circuit, the call shall be connected to the busy circuit provided that this call is not the sixth call at a facility. If it is the sixth, the call shall not access the voice call, but shall receive a busy signal.

3.5.2.2.2.6.4 Voice Call Release - Release of the circuit by the last position at either the calling or called facility shall disconnect the voice call. The voice call circuit shall be released by initiating a call disconnection.

3.5.2.2.2.7 Call Forwarding - The switching and control functions shall provide the capability to redirect any incoming G/G call from one position to another position within the same VSCS, in accordance with 3.3.2.2.6.4 and 3.3.2.2.6.5. A switching function shall automatically release any position having initiated call forwarding from receiving all subsequent calls until the forwarding feature is disabled.

3.5.2.2.2.8 RESERVED

3.5.2.2.2.9 Call HOLD - The switching and control functions shall provide the signaling and resources to hold calls and to resume calls as specified in 3.3.2.2.4.4.2, CA Queue Depth; and 3.3.2.2.5, Call HOLD.

3.5.2.2.2.10 Voice Routing - The switching and control functions shall provide voice routing for position monitoring, voice recording, HS/LS selection, and position relief briefing recording.

3.5.2.2.2.10.1 Monitoring - The switching and control functions shall recognize a request for monitoring from the entry/display function and shall establish the connectivity to the position to be monitored. There shall be no monitored transmission-level change on any connection established at the monitored position.

3.5.2.2.2.10.2 RESERVED (See Addendum 1)

3.5.2.2.2.10.3 Voice Recording - All voice signals (i.e., all A/G communications and G/G communications including the position briefing) on all circuits entering and leaving each position shall be combined on a per position basis and connected directly to the Government Furnished Equipment (GFE) legal voice recording system. The combining point shall be prior to any Volume Controls and the output shall be -10 dBm with a nominal Test Tone into an interface point on the Jack Module. Other requirements for the voice recording interface shall be as specified in the VSCS-REC IRD (See 3.6.9).

3.5.2.2.2.10.4 HS/LS Voice Routing - The switching function shall provide voice routing as selected by position operators.

3.5.2.2.2.11 RESERVED (See Addendum 1)

3.5.2.2.3 Trunk Signaling

3.5.2.2.3.1 Trunk Signaling VSCS-VSCS - The control and supervisory signaling for VSCS-VSCS interfacing and the trunk circuit techniques implemented for VSCS shall be as defined by the VSCS/TCS Interphone IRD (See 3.6.18).

3.5.2.2.3.2 Trunk Signaling Interfaces with Existing Systems - The trunk interface, as specified in the VSCS-Trunks IRD (see 3.6.8), when appropriately classmarked and equipped with appropriate equipment, shall be capable of interfacing with the older analog systems including WECO 300. This interface shall use one of the following methods of signaling:

a. DA voice call signaling (type 9).
b. Selective signaling (type 5).
c. Immediate dialing (type 7).
d. Selective signaling in, voice call signaling out (type 4).
e. Selective signaling in, voice call or selective signaling out (type 4/5).
f. Ringdown signaling (type 3).
g. CO/PABX signaling (type 6).
h. Local dial line signaling (type 8).

3.5.2.2.3.3 Voice Call Signaling - The switching and control functions shall detect an incoming voice call by the presence of incoming voice signals on the line. Detection of voice signals below the threshold shall not cause the VSCS to respond to the signals. The threshold shall be -26 dBm0 (nominal test level).

3.5.2.2.3.4 Selective Signaling - The switching and control functions shall provide the capability to both receive telephone calls and originate calls to existing systems equipped with selective signaling systems. The switching and control functions shall make the necessary code translations to be compatible with the numbering plan used in the 300 system. The switching and control functions shall include the capability to emulate all signals for IP trunks to interface existing systems.

3.5.2.2.3.5 Immediate Dialing (Type 7) - The switching and control functions shall be capable of transmitting and receiving standard dial addressing as described in the VSCS-Trunks IRD.

3.5.2.2.3.6 Trunk Signaling, VSCS-PABX - The switching and control functions shall provide appropriate signaling to interface with the existing PABX for access to PSTN.

3.5.3 Supervisory and Maintenance Requirements

3.5.3.1 Internal VSCS Interfaces - The VSCS design shall provide for centralized access to VSCS control functions and data.

3.5.3.1.1 Centralized Operator Communication - The VSCS shall provide centralized access at designated positions for issuing of commands for functions that include, but are not limited to, status monitoring, performance monitoring, traffic data collection, RTQC information, and diagnostics initiation and results reporting.

3.5.3.1.1.1 Supervisory Positions - The VSCS shall include supervisory positions. Supervisory positions shall have access to control that includes, but is not limited to, requesting reconfiguration, establishing training positions, modifying the on-line functional capabilities of positions, and requesting special monitoring functions.

3.5.3.1.1.2 Maintenance Position - The VSCS shall include a maintenance position. The maintenance position shall have access to controls that will provide capabilities to perform all diagnostics and certification actions as described in 3.8.

3.5.3.1.2 Centralized Database - The VSCS shall provide centralized access to any on-line databases. The database design document required in 3.10 shall include those features of the database design applicable to switching and control functions.

3.5.3.2 Status Monitoring and Control - The monitoring of real-time system performance, the reporting of system status and failures, and the local maintenance control over system resources to facilitate continuation or restoration of VSCS operational service shall be provided to support RTQC. The status monitoring and control functions shall be consistent with the reliability and maintainability requirements in 3.7, and meet the maintenance functions in 3.1.9.

3.5.3.2.1 Operations Status Monitoring - The capability shall be provided to monitor operational functions to include, at a minimum, monitoring the operational status of A/G and G/G of all assignments within a facility. The status of these conditions shall be available for display at maintenance and designated ancillary positions.

3.5.3.2.2 Performance Status Monitoring - A real-time system performance monitor shall be provided to monitor system equipment status and report failures for dissemination to maintenance personnel. Results from periodic self-tests of equipment and indication of equipment failures shall be provided. This shall comprise, at a minimum, test reports on equipment, processors, memory, peripherals, internal interfaces, radio trunks, interfacility trunks, and the BUEC interface. Data paths shall be monitored by error detection and correction programs to ensure the integrity of transmitted messages. The data communications interfaces to external systems shall be monitored.

3.5.3.2.2.1 Performance Reporting - System equipment status, the detection of system failures, and the recovery measures taken shall be reported to the maintenance position.

3.5.3.2.2.1.1 Reports to Maintenance Position - System status shall be available at a 5-second periodic rate. Status output shall be selectable. In the event of a failure, an indication identifying the failed equipment, its relationship to the system, and a way of maintaining the level of availability shall be provided. Audible and visible alarms indicating the failure status shall be provided. Failures shall be categorized, prioritized, and stamped with time of detection in terms of Greenwich Mean Time (GMT). Where audible alarms are used, a muting capability shall be provided. All failure alarms shall be maintained until the problem has been resolved. Recovery alternatives shall be selectable.

3.5.3.2.2.1.2 RESERVED

3.5.3.2.2.1.3 RESERVED (See Addendum 1)

3.5.3.2.2.1.4 RESERVED

3.5.3.2.2.1.5 RESERVED

3.5.3.2.2.2 Failure Logging - All failures as reported to the maintenance position shall be logged and stored. The capability shall be provided to format failure reports and select output data according to, at a minimum, date, time, and equipment type for display and hardcopy output.

3.5.3.2.3 Control - Automatic switchover to redundant equipment, as available, shall be provided in the event of a failure. The recovery time shall be within limits specified in 3.7.2, Reliability. The maintenance position shall be provided the capabilities required to control the recovery from system failures, the execution of diagnostics, and the output resulting from the monitoring function.

3.5.3.2.3.1 Failure Recovery - In the event of system fault or failure, recovery shall be initiated automatically by switching to redundant equipment or circuits. The recovery time shall be within limits specified by 3.7.2.3, Redundancy. In the event of the degradation of the A/G primary communications switch, the VSCS shall provide for the automatic switchover to the A/G backup switch as defined in 3.5.2, Switching and Control Functional Requirements, and in accordance with 3.2.2, Performance. The maintenance position shall have the capability to initiate manual recovery procedures to maintain system performance by reconfiguring the system around the problem areas. Failures shall be reported, and recovery options shall be selectable.

3.5.3.2.3.1.1 Functional Recovery - After position failure recovery without an intervening position-level reconfiguration of that position, the position equipment shall return to the configuration in effect prior to the failure, including any temporary changes to that configuration. After failure recovery, electronic patch panels shall also return to that operational configuration.

3.5.3.2.3.1.2 Voice Path Recovery - Sufficient voice paths shall be provided to meet the availability requirements of the communications functions.

3.5.3.2.3.2 Diagnostic Control - The maintenance position shall have the capability to initiate diagnostic testing for failure isolation. The maintenance position shall have the capability to establish any connection that can be provided to operational positions.

3.5.3.2.3.3 Reporting Selection Control - The maintenance position shall have the capability to select real-time status reports on tests. The status reports shall be selectable, at a minimum, by equipment types. Status shall be reported for operational and nonoperational equipment indicating, at a minimum, on-line, off-line, standby, and malfunctioning equipment. The maintenance position shall have the capability to select hardcopy output for all selectable status reports and failure reports.

3.5.3.3 On-line/Off-line Diagnostics - Diagnostics for self-testing, failure detection, and isolation shall be provided in both the on-line and off-line mode. Diagnostic test results shall be monitored and, in the event of a detected failure, reported to the maintenance position for appropriate corrective measures.

3.5.3.3.1 On-line Diagnostics - Built-in automatic self-testing of VSCS equipment shall be provided as specified in 3.8.2. Fault and failure detection and isolation shall be to the lowest replaceable unit level. All faults, failures, and recovery attempts shall be reported with alarms to the maintenance position. Manual self-testing initiated for position equipment and loop-back testing shall be provided. Performance monitoring and fault and failure reporting for manual self-testing shall be as for automatic built-in self-testing.

3.5.3.3.2 Off-line Diagnostics - The capability shall be provided to the maintenance position to initiate automatic and manual diagnostic procedures for off-line equipment. Off-line equipment is that equipment which is currently not part of the operating system due to either automatic switchover to backup equipment or equipment out of service due to reconfiguration. Diagnostics shall be for fault and failure isolation to the lowest replaceable unit in accordance with the certification requirements in 3.8. Diagnostics test results shall be reported to the maintenance position.

3.5.3.3.3 Diagnostic Interfaces - The VSCS shall provide access to diagnostic testing, fault and failure reporting, and recovery initiation.

3.5.3.3.3.1 Maintenance Position Interfaces - Centralized access shall be provided to maintenance position for requesting diagnostics, reporting results, and initiating recovery procedures.

3.5.3.3.3.2 RESERVED

3.5.3.3.3.3 RESERVED

3.5.4 System Management Functions

3.5.4.1 Reconfiguration - The control function shall provide the capability to reconfigure the operational features and communications assignments of all positions within a facility.

3.5.4.1.1 Characteristics - For reconfiguration purposes, the hardware configuration can be described in terms of the number and identity of positions within a facility: the type, identity, and number of trunks; and the configuration of the radio interfaces and BUEC resources. The operational configuration, as used here, is described as the assignment of communications and functional capabilities using the trunks, the radio interfaces and the BUEC, to each operational position within a facility. Reconfiguration shall provide for the reassignment of communications and functional capabilities and ensure the connectivities required to implement the assignments.

3.5.4.1.1.1 Configuration - A facility will have configurations mapped out to operate under different sets of conditions. Configurations shall be comprised of physical maps defining the hardware configurations of a facility, facility configuration maps defining the communications and functional assignments of all positions within a facility, and switch maps defining the desired connectivity for the switching hardware. Position configuration maps define the logical communications assignments and classmarks restricting communications and functional capabilities for operational positions. Sector configuration maps are the logical groupings of position configuration maps. Area configuration maps are the logical groupings of position and sector configuration maps. Facility configuration maps are the logical groupings of position, sector, and area configuration maps.

3.5.4.1.1.1.1 Physical Maps - Physical configuration maps define the hardware configuration of a facility. The physical configuration of a facility changes only as a result of automatic equipment switchover due to hardware failure, in response to reconfiguration commands, and as a result of updates to the radio interface site adaptation data.

3.5.4.1.1.1.1.1 Service Classmarks - Classmarks assigning or restricting classes of service for trunk circuits and radio interfaces shall be defined in physical configuration maps.

3.5.4.1.1.1.1.2 Physical Characteristics - Facility characteristics defined in physical maps shall include, at a minimum, the following:

a. Interfacility trunk ports.
b. PABX trunk ports.
c. Radio interface configuration resources.
d. BUEC system configuration resources.
e. Position ports.

3.5.4.1.1.1.2 Position Maps - Position configuration maps define the logical communications assignments and classmarks restricting communications and functional capabilities for operational positions. The capability shall be provided to logically group position configuration maps by sector, area, and facility configurations.

3.5.4.1.1.1.2.1 Operational Classmarks - Classmarks restricting communications and functional capabilities are defined in position configuration maps. Classmarks shall include, at a minimum, those listed in Table XIII.

Table XIII. Classmarks

For an operational position:
A/G capabilities and displays Reconfiguration initiation authorization Data access authorization Alarm/alert reporting Access to operational reports
For A/G communication capabilities:
Selective/split operations Transmitter/receiver site selection RESERVED BUEC access M/S transmitter selection M/S receiver selection Remote receiver muting PTT preemption RESERVED
For G/G communications capabilities:
DA call override IA call override Conference call initiation Position voice monitoring RESERVED PTT for G/G communications Access to and from PABX and PSTN Latching/nonlatching type of call activation Voice Call

3.5.4.1.1.1.2.2 Communications Assignments - Assignments for communications connectivity as defined in position configuration maps shall include, but not be limited to, the following:

a. A/G communications.

1. Frequency assignments.
2. BUEC frequency assignments.
3. Transmitter/receiver (or transceiver) sites for each frequency.

b. G/G communications

1. DA assignments.
2. Conference call access.
3. IA assignments.
4. Monitor capabilities.

3.5.4.1.1.1.2.3 RESERVED

3.5.4.1.1.1.3 Switch Maps - For each position, sector, area, and facility configuration map, a switch map shall be provided to define the desired connectivity. The switch map shall define the connectivity translations from the position maps to the physical configuration map.

3.5.4.1.1.1.4 RESERVED (See Addendum 1)

3.5.4.1.1.1.4.1 RESERVED (See Addendum 1)

3.5.4.1.1.1.4.2 RESERVED (See Addenda 1 & 2)

3.5.4.1.1.1.4.3 RESERVED (See Addendum 1)

3.5.4.1.1.1.5 RESERVED (See Addendum 1)

3.5.4.1.1.2 Configuration Database - Configuration maps are entered into the configuration database and their relationships defined. The creation and maintenance of the configuration database shall be provided for off-line. The configuration database shall be downloaded from the off-line system to the operational system. The on-line configuration database shall be locked out to updates during the reconfiguration process.

3.5.4.1.1.3 Reconfiguration Levels - The capability for reconfiguration on four levels shall be provided:

a. Position level.
b. Sector level.
c. Area level.
d. Facility level.

3.5.4.1.1.3.1 Position-level Reconfiguration - Position-level reconfiguration shall be provided to permit the selection of a different position map for an existing, previously assigned logical position. The capability shall be provided to add or delete position communications assignments and to modify classmarks for any operational position in accordance with 3.4.5.3.

3.5.4.1.1.3.2 Sector-level Reconfiguration - Sector-level reconfiguration provides for the assignment of communications capabilities required for sector control to individual positions within a sector suite. For example, a position would have A/G communications capabilities, and another position would have G/G communications capabilities. The capability for sector-level reconfiguration shall be provided to support sector roll-in and sector roll-out. Sector roll-in is the combining of sector communications capabilities at a sector position; sector roll-out is the distributing of communications capabilities among the sector positions.

3.5.4.1.1.3.3 Area-Level Reconfiguration - Area-level reconfiguration shall be provided to support combining and decombining of individual sector communications capabilities. Usually two or three adjoining sectors are combined into a single larger sector and controlled from a single sector suite during light traffic periods. This larger sector is then decombined to individual sector suites during busy periods.

3.5.4.1.1.3.4 Facility-level Reconfiguration - Reconfiguration on a facility level shall be provided to support a shift change affecting more than one area within a facility. Facility-level reconfiguration shall also be provided to support the combining and decombining of sectors over area boundaries, system initialization, and facility backup. Facility backup will be achieved by expanding the airspace controlled by facilities surrounding a failed facility. Facility-level reconfiguration shall also support the entire resectorization of airspace, establishment of new airways, and the creation of new sectors.

3.5.4.1.1.4 Timing Performance - Reconfiguration timing performance shall be as specified in 3.2.2.4.

3.5.4.1.2 Reconfiguration Process - The VSCS shall perform reconfiguration at the supervisor's option.

3.5.4.1.2.1 Reconfiguration Execution Sequence - The source of reconfiguration commands will be an appropriately classmarked VSCS console. These consoles are referred to as "the controlling position." The controlling position will send a command to the VSCS to begin the reconfiguration sequence. The controlling position shall send a command to the VSCS to implement the reconfiguration. Prior to the introduction of the AAS, the reconfiguration initiation and execution commands shall be manual inputs from the VSCS supervisor's console.

3.5.4.1.2.2 RESERVED

3.5.4.1.2.3 Reconfiguration Initiation by Supervisory Positions - Authorized supervisory positions shall be provided the capability of initiating changes to facility-level reconfigurations and area, sector, and position-level reconfigurations defined within an established facility configuration and within the areas of their supervision. This capability is defined and restricted by classmarks in the configuration maps defined for supervisory positions. The reconfiguration options shall be displayed to the supervisory position, and the capability shall be provided for selection of the desired reconfiguration.

3.5.4.1.2.4 Reconfiguration Initiation by Maintenance Position - The maintenance position shall be provided the capability to initiate the reconfiguration of trunk circuits and position-level reconfiguration, as classmarked. The available options shall be displayed to the maintenance position. The capability shall be provided for selection of the desired reconfiguration.

3.5.4.1.2.5 Priority of Reconfiguration Commands - A facility-level reconfiguration command shall have priority over any lower level area, sector, or position-level reconfiguration command. Area, sector, and position-level reconfigurations shall be provided within an established facility configuration. The priority in processing reconfiguration commands shall be for commands initiated by the area manager, by supervisory positions, and then by the maintenance position. A reconfiguration in progress shall not be interrupted by a subsequent reconfiguration command.

3.5.4.1.2.6 Initiation Commands - Prior to the introduction of the AAS, the VSCS shall receive commands directly from the area manager, authorized area supervisory positions, and the maintenance position. Reconfiguration initiation command inputs shall include at least the identification of the logical map to be implemented.

3.5.4.1.3 Operational Sequence - Prior to implementation of a reconfiguration, the authority, as classmarked, of the position requesting the reconfiguration shall be validated. Upon validating the reconfiguration command, the required maps shall be identified in the configuration database and made available to the display and switching functions for implementation. Execution of reconfiguration shall not in any way interrupt or disturb calls in progress or lose incoming communications. An indication of reconfiguration completion shall be provided to all positions being reconfigured.

3.5.4.1.3.1 Simultaneous Reconfigurations - The capability shall be provided for simultaneous execution of nonoverlapping position-, sector-, and area-level reconfigurations and changes to the physical console assignment. Simultaneous reconfigurations shall not reconfigure the same positions.

3.5.4.1.3.2 A/G Backup Switch Reconfiguration - The A/G backup switch capability as specified in 3.5.2.1.4 shall be provided the current A/G configuration as implemented.

3.5.4.1.4 Monitor and Control - Upon receiving a reconfiguration initiation command, the reconfiguration operational sequence shall be controlled and monitored. The control function shall accept status and acknowledgments from the display and switching functions as to the progress of their respective reconfigurations. The display and switching functions shall acknowledge reconfiguration initiation. Execution shall be in accordance with 3.2.2.4, Reconfiguration Timing Requirements, or shall follow completion of any calls in progress, at which time completion status shall be provided. The initiation and completion of the reconfiguration process shall be reported to the initiator of the reconfiguration and to supervisors of areas affected by the reconfiguration. The capability shall be provided to the initiator and to the affected area supervisors to request a report of the current status of each reconfiguration in progress. This status shall include, as applicable, at least the following:

a. Reconfiguration initiated.
b. Sector positions or trunks being reconfigured.
c. Completion pending release of calls in progress.
d. Reconfiguration completed.
e. Fault or failure reports.

The capability shall be provided to the initiator of the reconfiguration and to the supervisors for reconfiguration within the area of their responsibility to initiate recovery procedures as defined in 3.5.4.1.6.2.

3.5.4.1.5 Configuration Database Management - A database management system shall be provided to create, update, maintain, and restrict access to the configuration database. A validated configuration database shall be available in real time to meet the reconfiguration needs of an operating facility. The creation and maintenance of the configuration database shall be accomplished in an off-line or background mode.

3.5.4.1.5.1 Database Contents - The database shall consist of the physical configuration map; all position maps defined for each position within a facility; the area, sector, and facility maps defining the logical groupings of position maps; and the switch maps relating the physical and logical maps. The contents of sector, area, and facility maps shall be as required to implement any operational sequences for the desired reconfigurations.

3.5.4.1.5.2 Database Size - The configuration database shall be capable of containing all position, sector, area, and facility maps necessary to support the operational requirements for routine and emergency reconfigurations within a facility. The capability shall be provided to define, at a minimum, 15 position maps per position in the configuration database. The capability shall be provided for the configuration database to contain at least the following: 15 sector maps per airspace sector, 150 area maps per area, and 25 facility maps per facility. Storage shall be sufficient to maintain the configuration database, backups of the configuration database, and maps and databases under development in support of resectorization.

3.5.4.1.5.3 Map Creation - The capability shall be provided to create configuration maps defining the functional capabilities and communication assignments and classmarks for A/G and G/G communications for each operational position. The capability to develop maps identifying positions, independent of their physical address, and specifying connectivity between positions shall be provided. The capability shall be provided to logically group position maps into hierarchical structures of sector, area, and facility maps. The capability shall be provided to develop physical maps defining the hardware configuration of a facility and to develop switch maps relating the logical and physical maps. The capability to enter additional maps into the database shall be provided.

3.5.4.1.5.4 Map Modification - The capability to modify existing configuration maps off-line shall be provided. The capability shall be provided to extract, replace, add, delete, copy, and modify any map or part of a map within a configuration database.

3.5.4.1.5.5 Map Validation - Maps shall be interactively validated to ensure that under each configuration the connectivities for each position are achievable. Validation procedures shall also be provided for maps already included in a database.

3.5.4.1.5.6 Database Utilities - Utilities to maintain the configuration database shall include at least the following functional capabilities:

a. Database creation and deletion.

b. Map creation and deletion.

c. Update of maps.

d. Journaling: maintaining a log of all changes made to a database to support long- and short-term recovery procedures.

e. Long- and short-term recovery procedures to recover a corrupted database in event of user error or hardware or software failure.

f. Database utilization and timing monitoring utilities with interactive capabilities as well as capabilities to output to a file for later analysis.

g. Data definition language.

h. Data manipulation language.

i. Database integrity verification utility.

j. Database lock mechanism.

k. Database security mechanisms.

l. Database backup utility.

m. Database compression utility.

3.5.4.1.5.7 Database Access - A designated position shall have the capability to create, modify, and validate the configuration database. The capability shall be provided to control and access all database utilities. The capability shall be provided to download the configuration database and configuration maps to the operational VSCS and to back up the operational configuration database and configuration maps to the off-line system.

3.5.4.1.6 Recovery Processes - In the event of failure detection by the monitoring function during the reconfiguration process, recovery shall be initiated automatically, when possible, or initiated through manual procedures. The recovery procedures shall be in accordance with the recovery procedures as described in 3.5.3, Supervisory and Maintenance Requirements.

3.5.4.1.6.1 Automatic Recovery - Recovery from a failure of an element used by the reconfiguration process shall be automatic when a redundant element is available. The reconfiguration process shall be automatically retried three times from the last logical step successfully completed, and shall then be flagged for manual recovery.

3.5.4.1.6.2 Manual Recovery - The capability to employ manual recovery methods shall be provided to recover from any failure of the reconfiguration process. Recovery shall automatically reestablish the previous operational configuration. Manual recovery capabilities shall include, at least, the following:

a. Canceling a reconfiguration request prior to completion.
b. Canceling a logical area reconfiguration within a facility reconfiguration request.
c. Canceling a logical sector reconfiguration within an area reconfiguration.
d. Canceling a logical position reconfiguration.
e. Retry of a canceled reconfiguration after failure correction.

3.5.4.2 Traffic Data Collection - The VSCS shall have the capability to collect communications traffic data. Communications traffic data collection shall not interfere with and shall not degrade the performance or throughput of any VSCS communications processing.

3.5.4.2.1 Traffic Data - Communications traffic information shall include A/G communications functions, G/G communications functions, reconfiguration status, and time-of-day reset. Traffic data shall be formatted data records, using data coding as approved by the FAA, containing, at a minimum, a GMT time stamp and communication traffic information. The time-stamp shall be accurate to within 1.0 second of the occurrence of the recorded event.

3.5.4.2.2 Traffic Data Collection - The VSCS shall have the capability to collect traffic data on a continuous basis.

3.5.4.2.2.1 Voice Communications Traffic Data Collection - Voice communications traffic data shall include, at a minimum, information on position incoming and outgoing communications, on position call initiations and terminations, on call processing times, on position relief briefing; on call types such as DA, IA, IC, IP, OVR, voice calls, conference calls, trunk calls, A/G calls, and PTT.

3.5.4.2.2.2 Other Communications Traffic Data Collection - Other communications support functions shall be available for traffic data collection. These functions shall include, at a minimum, selection of M/S for transmitters/receivers, activation/deactivation of BUEC for a frequency, reconfiguration processing time, activation of special call features such as IA OVR, CA queue call selection, and the activation of special call functions such as monitoring, and call forwarding.

3.5.4.2.3 RESERVED

3.5.4.2.3.1 RESERVED

3.5.4.2.3.2 RESERVED

3.5.4.2.3.3 RESERVED

3.5.4.2.4 RESERVED

3.5.4.2.4.1 RESERVED

3.5.4.2.4.1.1 RESERVED

3.5.4.2.4.2 RESERVED

3.5.4.2.4.3 RESERVED

3.5.4.2.5 Data Transfer - The VSCS communications traffic information collected shall be transferred to mass storage. Mass storage shall be capable of saving, at a minimum, all data collected during one (1) day. Data that is to be transferred to mass storage shall be validated prior to the transfer. Controls shall be provided to prevent loss of data before, during, and after data transfer.

3.5.4.2.5.1 Data to Tape - A classmarked position shall have the capability of initiating and terminating VSCS communications traffic information collection to magnetic tape. The classmarked position shall have the capability to collect traffic information on all or selected groups of traffic information.

3.5.4.3 System Startup - The control function shall manage the orderly startup of the VSCS. Diagnostics shall be requested from all functional areas on system startup and reported as required. The facility configuration map identified during startup procedures shall be implemented. The configuration data base and operational programs shall be downloaded.

3.5.4.3.1 Warm Start - Warm start of the VSCS shall be provided. The current configuration of the operational system shall be recorded and that record updated. In the event of hardware or software failure, the operational program shall be restarted without reloading the configuration database, reloading the radio interface site adaptation data, or losing the current selections at any operational position.

3.5.4.3.2 RESERVED

3.5.4.3.3 RESERVED (See Addendum 1)

3.5.4.4 Timing and Synchronization - The VSCS shall provide for time-of-day reference for administrative purposes. It shall also contain provisions for accepting system timing and synchronization from the master network source.

3.5.4.4.1 Time of Day - The VSCS shall provide a time-of-day reference that shall be capable of maintaining year, month, day, hour, minute, and second. The VSCS shall provide for the manual entry of the time of day.

3.5.4.4.1.1 Reset of Time of Day - The VSCS shall provide a capability to manually reset the time of day. The VSCS shall provide the capability to automatically reset the time of day to conform to the external time source.

3.5.4.4.2 System Timing and Synchronization - The VSCS shall be capable of interfacing and synchronizing with external digital voice networks to support synchronized digital communication.

3.5.4.4.2.1 Clock Stability - The VSCS shall provide a clock with a long-term, free-running drift rate of no more than one part in 10^{10} per day.

3.5.4.5 Support Processing - A capability shall be provided so that startup or failure of support processing hardware or software shall not cause a loss of on-line VSCS functions and shall not degrade the on-line VSCS activity. Support processing capability shall be provided to perform those functions that need not be performed on-line in real time. Any of the support functions may be performed in the background mode, with FAA approval, providing sufficient capacity is available and that it can be demonstrated that such functions shall not have an effect on VSCS on-line throughput.

3.5.4.5.1 Interface to On-Line System - In the event support processor(s) are used, a high-speed interface of at least 1.5 megabits per second shall be provided to support the downloading from the support processor to the on-line processors of the configuration database and the operational program and remote booting capabilities for on-line processors.

3.5.4.5.2 Functional Description - Use of support processors shall not require knowledge of the internal retrieval and storage mechanisms and other technical aspects of the system. Display formats shall be designed to provide optimum transfer of information to the user, and data shall be presented to the operator in a readily usable and readable format. Support processors shall be provided to support at least the following functional requirements:

a. Reconfiguration database management.
b. RESERVED
c. RTQC data formatting and reporting.
d. VSCS operational program startup.
e. Changes to operating system and software.

3.5.4.5.2.1 Reconfiguration Database Management - Support command procedures, programs, and processors shall be provided to aid in creating and managing the database required for the reconfiguration process. These processors shall function as an interface to the database management system. Processors shall be provided to support at least the following functional requirements:

a. Screen formatting control.
b. Database access.
c. Map validation.
d. Report formatting and output.
e. Configuration downloading.

3.5.4.5.2.2 RESERVED

3.5.4.5.2.3 RTQC Data Collection and Reporting - Support processors shall be provided to support the report generation from logs of errors reported to the maintenance and NAS Manager positions. Processors shall be provided to support at least the following functional requirements:

a. Screen formatting control.
b. RTQC data formatting for storage.
c. Report formatting and output.

3.5.4.5.2.4 VSCS Operational Program Startup - Command language procedures and programs shall be provided to download and boot the operational program from the support processor, if support processors are used.

3.5.4.5.2.5 Changes to Operating System and Software - The support processor(s) shall provide the capability to incorporate necessary software and operating system changes in accordance with 3.10, Software. Changes made to on-line software or the operating system(s) shall not cause any loss of on-line VSCS functions, and shall not degrade nor perturb the on-line VSCS activity. However, the VSCS shall permit loss of on-line VSCS functions in the instance when a support processor is commanded by an appropriately classmarked operator, using the "Simultaneous Download" (Task E64) feature functionality, to perform logical entity startup on selected Processor Group Logical Entity(s).

3.5.5 RESERVED (See Addendum 1)

3.5.5.1 RESERVED (See Addendum 1)

3.5.5.1.1 RESERVED (See Addendum 1)

3.5.5.1.1.1 RESERVED (See Addendum 1)

3.5.5.1.2 RESERVED (See Addendum 1)

3.5.5.1.2.1 RESERVED (See Addendum 1)

3.5.5.2 RESERVED (See Addendum 1)

3.6 INTERFACES

3.6.1 General

This section provides a list of the external interfaces of the VSCS, which is also a directory of the pertinent Interface Requirements Documents (IRDs).

3.6.2 VSCS-ACCC (Common Console)

The physical and electrical interfaces between the VSCS and the ACCC shall be as described in the VSCS-ACCC (Common Console) IRD.

3.6.3 RESERVED

3.6.4 RESERVED

3.6.5 RESERVED (See Addendum 1)

3.6.5.1 RESERVED (See Addendum 1)

3.6.6 VSCS-BUEC

This interface shall provide an A/G voice communication path into the Backup Emergency Communication (BUEC) radio equipment. The interface between the VSCS and BUEC shall be as described in the VSCS-BUEC IRD.

3.6.7 VSCS-PABX

The interface between the VSCS and the Private Automatic Branch Exchange (PABX) shall handle access to PSTN and FTS. The VSCS-PABX interface shall be as described in the VSCS-PABX IRD.

3.6.8 VSCS-Trunks

VSCS interfaces to trunks shall be governed by the VSCS-Trunks IRD.

3.6.9 VSCS-REC

The Recording System (REC) provides tape recording facilities that make a legal record of all ATC voice communications. The interface between the VSCS and REC shall be as described in the VSCS-REC IRD.

3.6.10 RESERVED (See Addendum 1)

3.6.11 RESERVED

3.6.12 ACF-VSCS - The VSCS shall be designed to interface with the Area Control Facility in accordance with the ACF-VSCS IRD.

3.6.13 RESERVED

3.6.14 VSCS-Power

The VSCS shall be capable of drawing power either from FAA's power conditioning system (PCS) or from commercial AC line power according to operating environment. The power connection shall be in accordance with the VSCS-Power IRD.

3.6.15 RESERVED (See Addendum 1)

3.6.16 RESERVED

3.6.17 VSCS-Transmission Equipment (Analog)

The Transmission Equipment (Analog) provides the transmission media for trunks. The interface between the VSCS and the Transmission Equipment shall be described in the VSCS-Transmission Equipment (Analog) IRD.

3.6.18 VSCS-TCS

The VSCS and TCS will be functionally connected as a voice communications network. Standard methods of supervisory and address signaling will be utilized to construct the network. The VSCS shall be designed to interface to voice switches in accordance with the VSCS/TCS Interphone IRD.

3.7 SYSTEM RELIABILITY AND MAINTAINABILITY REQUIREMENTS

This section defines and describes design requirements that shall be achieved and elements that shall be implemented for the VSCS RMA program. The Preliminary RMA Program Plan shall contain elements for a reliability program and a maintainability program.

3.7.1 Definitions

The Reliability, Maintainability and Availability (RMA) terms are defined in Appendix I and MIL-STD-721.

3.7.2 Reliability

3.7.2.1 Single-point Failure - The VSCS shall be designed not to permit single-point failures that impede the accomplishment of system objectives as defined by this system specification.

3.7.2.2 Secondary Failure - The VSCS shall be designed not to permit the propagation of primary failures to other devices, components, or assemblies.

3.7.2.3 Redundancy - When redundant elements are used in the VSCS to meet the specified availability requirements, they shall be switched on-line without degradation of system performance. Automatic switching time shall not exceed 50 msec to restore a given position function, 100 msec to restore an operable S/S, and 10 seconds to restore an operable facility. The loss of A/G function for more than 100 msec shall be acknowledged by loss of side tone and flutter. When manual redundancy switching is required, the time to switch in redundant elements shall take no more than automatic switching time to restore operability, independent of manual diagnostic time.

3.7.2.4 Reliability Program - The reliability program for the VSCS has as its objective the efficient and effective use of programmatic tools in the achievement of RMA requirements. To this end, the reliability program shall use MIL-STD-785 in the tailoring of program elements to the VSCS. The time phasing of these reliability program elements shall be developed in accordance with the VSCS Program life cycle; e.g., all program milestones shall be reflected in the reliability task phasing. The RMA inputs and outputs that contribute to the achievement of these milestones shall be clearly identified.

3.7.3 Maintainability

3.7.3.1 RESERVED (See Addendum 1)

3.7.3.2 Preventive Maintenance (PM) - Any PM that causes a failure to any function or functionality being used in operations shall be counted as corrective maintenance. The design goal for the VSCS shall be directed toward no system interrupting PM. All PM will be limited to lowest traffic intensity periods. Mean time between preventive maintenance actions (MTBPMA) for any item shall not be less than 90 days.

3.7.3.3 Mean Time to Repair (MTTR) - Equipment MTTR shall not exceed 30 minutes for corrective maintenance, subject to maintainability analyses and demonstration. The final allocated MTTR shall be determined for each self-contained functional unit in terms of bringing the system back to being fully functional with redundancy. The mean bench repair time (MBRT) for VSCS LRUs shall not exceed four (4) hours.

3.7.3.4 Maintenance Requirements - For all VSCS equipment, the quantitative maintainability requirements shall be based on the removal and replacement of modules, using system specialist-level maintenance technicians. In this regard, a module shall be a Line Replaceable Unit (LRU), such as a printed circuit assembly or equipment. The system shall be designed for rapid fault isolation through the designated use of automatic on-line fault isolation, BITE, and BIT capability. The system design shall have as a requirement on-line fault-isolation capability to one or two modules in 95% of all failures, and to one module in 85% of all failures.

3.7.3.5 Service and Access - For all VSCS equipment, design for ease of servicing and access shall be in accordance with 5.9, 5.10, 5.11, and 5.13 of MIL-STD-1472. All modules and equipment shall be completely removable from their enclosure without excessive disassembly. All test points shall be accessible without disassembly of the equipment. The equipment shall be designed to permit modular replacement without removal of adjacent modules. Calibrations and adjustments shall be accomplished through the use of either built-in meters and gages, or with portable test instruments. When safety allows, access shall be provided to modules from outside the basic equipment through the use of swing-out units, pull-out drawers with drawer slides, cable extenders, and cable retractors. The variety and number of special tools and test equipment required to maintain the equipment shall be held to a minimum.

3.7.3.6 Test Points - For all VSCS equipment, test points and facilities for interconnecting test equipment shall be provided for determining the performance quality of the equipment. Test points shall be in accordance with MIL-STD-415.

3.7.3.7 Modules - All equipment shall be designed to use modular construction, and the number of unique module types shall be kept to a minimum. All modules shall be plug-in type modules where practicable, and shall have positive locking mechanisms to prevent loosening. Plug-in modules shall be standardized to permit interchangeability of like modules without alignment or adjustment. All modules shall be keyed to prevent incorrect installation. Splitting of single functions across more than one module shall be avoided.

3.7.3.7.1 Functional Partitioning - The equipment shall be packaged in modular form, which is easily isolatable for maintenance/repair. Functions shall be allocated such that they are totally contained in single modules where possible. More than one function can be included in a module, but each function shall be complete where possible. Splitting of single functions across more than one module shall be avoided.

3.7.3.8 Diagnostic Requirements - The VSCS shall provide the capability for air-traffic-controller-initiated action to confirm operability of any position functions. This confirmation will be derived from the results of automatic diagnostics that run as background activity to verify function operability. These background diagnostics will verify functionality of on-line items and off-line "power-on" items. The air traffic controller shall be able to confirm operability of the position within three (3) seconds and confirm operability of any selected function within one (1) second after request.

The VSCS shall provide the capability to the maintenance position for verifying the VSCS operability of any air traffic controller position functions, any sector suites, the total facility, any set of position functions, and any set of sector suites. Each confirmation will be presented to the maintenance position within three (3) seconds after request.

3.7.3.9 Maintainability Program - The VSCS maintainability program has as its objective the design/development and installation of a system with the greatest inherent ability to be maintained consistent with other program objectives. The program plan shall emphasize all aspects of design where life-cycle costs may be effectively reduced by enhanced repairability, testability, and maintainability.

The VSCS maintainability program shall be developed from the tasks described in MIL-STD-470, to the extent indicated in the VSCS Request for Proposal. The inputs and outputs from maintainability tasks that contribute to the achievement of the milestones shall be clearly defined.

3.8 VERIFICATION

3.8.1 Plan

The system, function, and equipment certification for the VSCS shall be in accordance with the Maintenance Plan.

3.8.1.1 Automatic Verification - Automatic verification routines shall be provided within the VSCS to verify lower level functionality. Initiation of all verification routines may be performed manually, and maintenance personnel may interrupt any automatic verification routines. Results from these routines shall be directed to the maintenance person via the VSCS maintenance position. All results presented to the maintenance person shall provide the complete basis necessary for certification of system functionality.

3.8.2 BIT/BITE

BIT capability is the collection of functions that allow selective testing of the functionality containing the BIT or of a closely related functionality. BITE is one form of BIT in which the test functions are resident in a set of dedicated circuits contained within, but not a part of, the functionality to be tested. The other predominant form of BIT is usually software and is associated with the system as a whole or is part of a processor within the system.

3.8.2.1 BIT/BITE Functions - Whichever form BIT/BITE takes, it shall function within the VSCS environment to: (a) permit detection and isolation of malfunctions down to the LRU, and (b) permit certification, from full system to the LRU level, that a VSCS functionality, which may contain a repaired or replaced LRU, is performing properly.

3.8.3 Applicability

Certification shall be required in the following cases:

a. Verification of proper functional operation upon completion of necessary repairs.
b. Verification of the readiness of equipment not in service to be activated by reconfiguration activities.
c. Daily verification of system performance.

3.8.4 Methodology

Certification in the VSCS environment is the use of BIT/BITE to determine the readiness of a VSCS functionality to perform its specified functions. All BIT/BITE will be transparent to operational use, except for controller-initiated functional path verifications. BIT/BITE shall have adequate capability to determine this readiness to a confidence of 99%. This means that in 99 out of 100 attempts to determine readiness, it is expected that at least 99 will give affirmative results when this is the true state of the system. When a specific functionality, by virtue of its critical importance, requires a higher degree of confidence, added testing shall be used at any operational console on a non-interference basis. This testing shall be accomplished using portable and/or centralized test diagnostics and shall be applied, as follows:

a. Digital signal paths shall be verified by inserting appropriately structured bit streams or test words and comparing the outputs with expected values.

b. Pulse-coded signal paths shall be verified by inserting appropriate analog signals, covering the frequency range of the path being tested, in a position ahead of the pulse-code circuitry, and comparing coded outputs with expected values. The analog signals shall have at least the highest and the lowest frequencies to be passed included in seven frequency intervals represented in the test signals. The distortion shall be tested by using filters to separate fundamentals and using the residuals as a test value.

c. Analog signal paths shall be verified by inserting appropriate analog signals, covering the frequency range of the circuit, and comparing outputs to expected values. The analog signals shall have at least the highest and the lowest frequencies to be passed represented in the test signals. This shall help to verify that the frequency response requirements for frequencies between 300 Hz and 3000 Hz are in accordance with 3.2.2.6.6. The distortion shall be tested by using filters to separate fundamentals and using the residuals as a test value.

3.9 SYSTEM DESIGN AND CONSTRUCTION

The VSCS shall be designed and constructed so that all specified modularity, performance, and RMA requirements shall be achieved throughout the specified service life. Construction of the system equipment shall employ standardization of cabinets, modules, printed circuit assemblies, components, materials, processes, and workmanship.

3.9.1 Interchangeability

Mechanical and electrical interchangeability shall exist among all assemblies, subassemblies, and replaceable parts that are intended to be identical regardless of manufacturer or supplier (see MIL-STD-454, Requirement 7).

3.9.2 Dissimilar Metals

Dissimilar metals shall not be used where they will degrade or cause deterioration to the assembled parts. When dissimilar metals are used, they shall be coated or protected to inhibit or prevent degradation to other parts and assemblies.

3.9.3 Service Life

The equipment shall be designed and constructed to have a service life of at least 20 years with the maintenance principles specified in 3.7. During its service life, the VSCS shall operate continuously 24 hours per day.

3.9.4 Mechanical Requirements

3.9.4.1 Equipment Layout - All equipment shall be in accordance with the ground workspace design requirements of MIL-STD-1472, 5.7.1. Removable doors, if used, shall be designed to prevent contact with equipment while being removed or replaced. The equipment layout shall be accommodated within the space designated in the ACF/VSCS IRD (NAS-IR-61004201).

3.9.4.1.1 RESERVED (See Addendum 1)

3.9.4.1.2 Workshop and Storage Area Floor Space - All site level storage and workshop equipment necessary to support the VSCS shall be accommodated within an area of 15 ft (4.57 m) by 30 ft (9.14 m).

3.9.4.2 Module Removal and Insertion Damage - All equipment shall be designed for removal and insertion of modules and printed circuit assemblies without causing damage to the modules and printed circuit assemblies or to any equipment external to the module or printed circuit assemblies. Each module (LRU) shall be capable of being removed or inserted while power is on, or shall have keyed elements or interlocks to disable power to that LRU during removal or insertion. Plug-in modules and assemblies shall be designed to prevent insertion or connection when incorrectly oriented.

3.9.4.3 Printed Circuit Assemblies - Printed circuit assemblies shall comply with the requirements of MIL-STD-275. Terminology and definitions shall be in accordance with ANSI/IPC-T-50. Screwdriver adjustments required for alignment shall be located at the printed board edge.

3.9.4.4 Cabinet and Frame Construction - The equipment room cabinets and frames shall not exceed a height of 72 in. (1.83 m), a width of 49.500 in. (1.26 m), and a depth of 37.125 in. (0.94 m). The loading conditions of each fully equipped cabinet and frame shall not exceed 125 lb/sq ft. The maximum weight of a single empty cabinet or frame shall not exceed 200 lb. The structural strength and rigidity of the cabinets, consoles, and frames shall be such that normal handling in loading, shipping, unloading, and setting into position for installation will not result in any damage to the equipment. Removal of equipment or modules or interchanging of equipment or modules shall not cause any deformation to the cabinets or frames. Structural strength and rigidity of all cabinets shall be independent of any strength or rigidity provided by access doors. Equipment cabinets shall have removable tops and sides and shall have doors on the front and back. Removable components (except for the VSCS Electronics Module) shall not exceed a maximum weight of 60 lb to permit removal and replacement by one person with the exception of power supply modules, storage media drives, and VSCS electronic modules (VEMs). The VSCS Electronics Module shall not exceed a maximum weight of 60 lbs and shall permit removal and replacement by two persons. Removable equipment cabinet or frame-lifting devices (hooks, rings, etc.) may be installed for convenience to facilitate handling and installation.

3.9.4.4.1 Cabinets and Frame Prewiring - All equipment cabinets and frames shall be prewired to minimize on-site expansion wiring and cabling. Cabinet and frame prewiring shall be complete even though the number of cabinets or frames used to satisfy the capacity requirements specified at each site may not include a full complement of equipment or modules. Wiring and cabling accommodations shall be provided to interconnect future cabinets and frames that may be needed for site expansion (see Table I). All cables, wires, and harnesses shall be protected against chafing. Such protection shall be independent of the individual wire or cable insulation or jacket. Cable access shall enter and exit from the bottom of the cabinet or frame. Grounding shall be in accordance with 3.9.14.

3.9.4.4.1.1 Existing On-site Console and Frame Expandability - Existing consoles and frames in which VSCS equipment is to be installed shall be fully wired to accept all modules required.

3.9.4.4.2 Cabinet and Frame Convenience Outlets - The VSCS shall provide AC convenience outlets for cabinets and frames. The AC convenience outlets shall be independent of the primary power source for the equipment within the cabinets and frame, and in accordance with 3.3.2.1.7 of FAA-G-2100.

3.9.4.4.3 Cable Entrance and Exit - Cabinet or frame interconnecting cables shall normally enter and exit through a raised floor. Direct cabling through the sidewall of cabinets, at least 6 in. above the floor, may be used within a subsystem where distance is considered a critical factor in circuit performance. Direct cabling shall not in any way compromise the requirements of expandability.

3.9.4.5 Distribution Frames - An intermediate distribution frame (IDF) shall be provided by the contractor to facilitate the interconnection of all VSCS cables to the FAA-provided VSCS Distribution Frame and Radio Interface Intermediate Distribution Frame (VDF/RI IDF) system and the FAA-provided Master Demarcation System (MDS) Frame System. The IDF shall accommodate all VSCS interface requirements including the existing equipment-to-VSCS transition switch. Cables shall be provided to interconnect the IDF to the VDF/RI IDF and the MDS. The IDF shall be provided with blocks that allow incoming cables to be terminated on quick-connect terminals. All blocks shall have quick-connect terminals that allow both equipment an cross-connect wires to be terminated. The IDF shall be capable of accommodating at least 25% more connections than required for the capacity specified for each site.

3.9.4.5.1 Distribution Frame Cabling - All cables, cross-connects, and any additional cable trays needed shall be provided between the following entities: VSCS back room equipment and VCE; VSCS and the Contractor-provided IDF; Contractor-provided IDF and the FAA-provided VDF/RI IDF; Contractor-provided IDF and the FAA-provided MDS; Contractor-provided IDF and the transition switch. All cabling installations shall comply with FAA Order 6650.9.

3.9.4.5.2 Test and Measurement Access and Isolation - Access to and isolation of lines and equipment for monitoring, test, and measurement purposes shall be provided. Appropriate test points shall be provided in accordance with 3.7.3.

3.9.4.6 Protector Frames - Protector frames shall be provided as required.

3.9.4.7 RESERVED

3.9.4.8 Acoustic Noise Levels - Acoustic noise levels generated by the assembled and peripheral equipment shall not exceed the specifications of 3.3.1 of FAA-G-2100.

3.9.4.9 Intraconnection and Interconnection Cables - All intraconnection and interconnection cables and connectors required for factory testing, equipment site installation, checkout, acceptance testing, cutover, operation, and maintenance of the VSCS, for all VSCS installations, shall be designed for Government-furnished underfloor and overhead distribution and cabling facilities. All cabling installations shall comply with FAA Order 6650.9. VSCS cables shall connect electronic devices and modules associated with any transmission path. All such cabling shall permit accessibility to equipment for test maintenance and replacement. After installation, all cabling shall meet grounding requirements and electromagnetic compatibility (EMC)/conducted and radiated electromagnetic interference (EMI) requirements. Cabling and wiring shall comply with 3.5.5.25 of FAA-G-2100; National Electric Code, NFPA-70, 1990; and FAA-C-1217.

3.9.4.9.1 Cable Connectors - All cable connectors furnished on the equipment for making external connections shall be clearly identified on the plug-in side by word labels descriptive of their specific function and by the proper reference designation in accordance with 3.9 of FAA-G-2100. Cable connectors shall be mechanically keyed to prevent incorrect installation and hookup. The mating connector part (connector or plug) that is electrically engaged shall contain female contacts. All cable connectors shall have the capability to be mechanically retained in place.

3.9.4.9.2 Cable End Terminations - Signal cable end terminations shall be solderless, quick-disconnect terminal blocks and/or solderless, wire-wrap terminal blocks or connectors. Power cable end terminations shall be screw-type terminal blocks, pressure contact terminal blocks, or connectors. Where connectors are used, each connector shall be provided with 10% spare contacts. Connectors that have insert-type contacts need be loaded with only the contacts actually used plus spares.

3.9.4.9.3 House Cables - House cables connecting the console with the equipment located in the equipment room shall be terminated with female connectors at the console. These cables shall be designed for overhead and underfloor distribution. Connectors shall be provided with 10% spare contacts. Connectors that have insert-type contacts need be loaded only with contacts actually used plus spares. Connectors shall be keyed, and each cable end and its terminating socket must be clearly marked with the proper reference designations in accordance with 3.9 of FAA-G-2100.

3.9.4.9.4 Position Cables - Position cables connecting the console modules with other modules located at ATC positions shall be terminated with female connectors at the console module end of the cable. Connectors shall be provided with 10% spare contacts. Connectors with insert contacts need be loaded only with contacts actually used plus spares. Each cable end and its terminating socket must be clearly marked with the proper reference designations in accordance with 3.9 of FAA-G-2100.

3.9.4.9.5 Power Cables - All AC power cables and wiring within the VSCS shall be shielded from the voice and signaling circuits. All AC power shall be installed in accordance with National Electrical Code, NFPA-70. Cabling shall also include all junction boxes, fittings, and distribution equipment including switches and circuit breakers from the FAA power source to the VSCS primary power panel.

3.9.4.9.6 Grounding Cables - Grounding cables, wires, and buses for the ground systems specified in 3.9.14 shall comply with FAA-G-2100 and FAA-STD-019.

3.9.4.10 Cabinet Ventilation and Cooling - All blowers, vents, and cooling equipment necessary for the ventilation and cooling of the equipment shall be an integral part of the VSCS. Each cabinet requiring forced ventilation shall contain its own blower system and shall require no external ducts. The equipment shall not malfunction with access doors and plates open, and drawers extended for servicing, for up to eight (8) consecutive hours. Ventilation air intake shall be from the bottom of the cabinet; the cabinet design shall allow air intake from either below a raised floor or from floor level, by simple removal of cover plates or baffles. Air intakes shall be provided with air filters in all equipment cabinets. Ventilation exhaust shall be at the top of the cabinet through exhaust outlet openings. Ventilation exhausting from cabinets or consoles shall be designed such that no safety hazards are present to personnel in accordance with MIL-STD-454, Requirement 1. The NAS Transition Plan envisions positive-pressure, forced-air cooling for under floor spaces.

3.9.4.10.1 RESERVED

3.9.4.10.2 Overheat Warning - A warning device shall be provided in each separate cabinet to indicate when the temperature exceeds the maximum safe operating temperature for the equipment within the cabinet. A warning indicator, readily visible from the cabinet exterior, shall be provided on the cabinet. The overheat warning shall also be reported and displayed at the maintenance position. Overheat warning requires maintenance personnel action to determine the cause of warning and take corrective action.

3.9.4.11 Color and Texture of Finishes - The finish of all ATC operator position control modules shall have baked enamel paint or equivalent. The basic color and access panel colors shall be as specified by the FAA from the colors normally offered by the manufacturer. Access panels shall be in colors contracting with the basic colors. Paint systems for VSCS equipment shall comply with FAA-STD-001. Surface reflectivity shall be within the range of 30% to 50%.

3.9.4.12 Identification, Marking and Nameplates - Identification of system units shall be in accordance with 3.9 and 3.10 of FAA-G-2100.

3.9.4.13 VCE Quick Cable Disconnect - The VCE shall provide, as part of the design, a quick disconnect connector panel for all cables terminating at the VEM. The AC power and ground cables are excluded. The quick disconnect panel shall be removed instead of the cables when extending or removing the VCE from the Common Console.

3.9.5 Environmental Requirements

3.9.5.1 Temperature, Humidity, and Altitude Conditions - The VSCS shall be designed for all combinations of environmental conditions as shown in Table XIV. Operating service conditions apply under all fixed or slowly varying conditions of AC line voltage and frequency defined in Section 3.3.4 of FAA-G-2100. Nonoperating conditions, for which the environment is uncontrolled, include shipping and handling, and storage.

Table XIV. Temperature, Humidity, and Altitude Conditions

Condition	Ambient Temperature Degrees Centigrade, (Degrees Fahrenheit)	Relative Humidity % RH	Altitude, ft (m)
Operating *	+10 to +40 (+50 to +104)	10 to 80	0 to 10,000 (0 to 3,048)
Nonoperating	-50 to +70 (-58 to +158)	0 to 100	0 to 50,000 (0 to 15,240)

***** The condition is the range within which the facility air conditioning system is permitted to operate. It, therefore, represents the allowable operating heat sink condition to which the VSCS must dissipate the waste heat. A design margin range of 0 degrees C to +50 degrees C shall be included for the operating condition. See Figure 4-1.

3.9.5.2 Vibration and Shock Design Requirements

3.9.5.2.1 Random Vibration - Random vibration design requirements are specified in Table XV and Table XVa. The random vibration shall be assumed in each of the three mutually orthogonal axes at the mounting of the assembly. The design exposure time requirement is 10 minutes per axis. One axis may be assumed if substantial evidence can be given to show that there is a single axis that will reveal most of the workmanship and material faults in the VSCS equipment.

3.9.5.2.2 Shock Requirements - For shipment, proper packaging techniques shall be implemented to prevent damage from transportational vibration and shock. For unpackaged bench handling, the VSCS hardware shall withstand a four (4) inch pivotal drop and a one (1) inch (free) drop from any probable direction.

Table XV. Random Vibration Requirements for VSCS

Frequency, Hz	Level
20-1000 1000-2000 Overall	0.02 G^2/Hz -6 dB/octave 5.5 Grms

Table XVa. Random Vibration Requirements for Discrete and Monitor Unit (Only)

Frequency, Hz	Level
20-1000 1000-2000 Overall	0.006 G^2/Hz -6 dB/octave 3.0 Grms

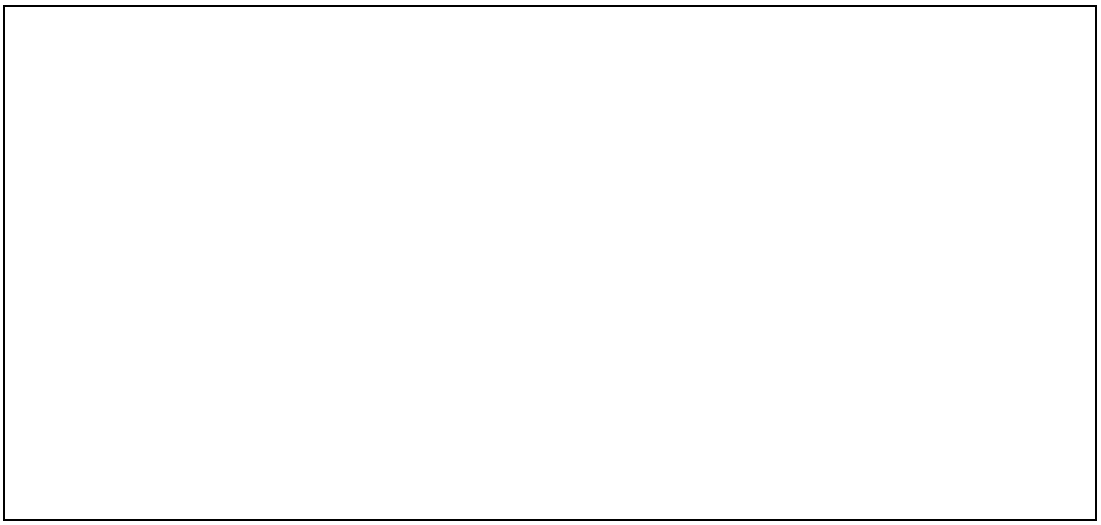

Figure 3-1. RESERVED

3.9.5.3 EMC/EMI Surveys - EMC/EMI surveys shall verify that the VSCS is not affected by electromagnetic radiations and does not affect other FAA systems.

3.9.5.4 Electromagnetic Interference Requirements - The VSCS equipment shall meet the following MIL-STD-461 requirements of Parts 1 and 7 when tested to MIL-STD-462. Modifications to MIL-STD-461 are also described below.

3.9.5.4.1 CE03, Conducted Emissions, Power and Interconnecting Leads, 0.015 to 50 MHz, Narrowband and Broadband - See Figures 3-2 and 3-3 for modifications.

3.9.5.4.2 CS01, Conducted Susceptibility, Power Leads, 30 Hz to 50 KHz - See Figure 3-4 for modifications. The frequency range within 10% of the rated power frequency shall be omitted.

3.9.5.4.3 CS02, Conducted Susceptibility, Power Leads, 0.05 to 400 MHz - The limit is 1 V rms over the frequency range.

3.9.5.4.4 CS06, Conducted Susceptibility, Spikes, Power Leads - The modified wave shape and limit are shown in Figure 3-5. Either the series or the shunt method may be used. Pulses may be manually actuated at any rate for a total of 20 pulses minimum.

3.9.5.4.5 RE02, Radiated Emissions, Electric Field, 14 KHz to 10 GHz, Narrowband and Broadband - See Figures 3-6 and 3-7 for modifications. The upper limit of the narrowband test (Figure 3-5) is 1 GHz if no clock pulse rate exceeds 200 MPPS. Any equipment with clock pulse rates exceeding 200 MPPS shall be tested to 10 GHz. Emissions from any displays using a cathode ray tube (CRT) must comply with Figure 3-8.

3.9.5.4.6 RS03, Radiated Susceptibility, Electric Field - Over the range of 14 KHz to 18 GHz, the electric field shall not exceed 1 V/m.

3.9.6 Federal Communications Commission (FCC) Registration

The VSCS shall provide the capability of interfacing with common carrier facilities. All systems and subsystems interfacing directly with these facilities shall be FCC registered. FCC equipment registration shall be in accordance with 3.3.1.1 of FAA-G-2100.

3.9.7 Electrical Power

3.9.7.1 VSCS Switching Equipment - The VSCS switching equipment, including the A/G backup switch and control, shall operate from the PCS as follows:

a. Voltages: 120 V ± 10%, single phase; or 208 V ± 10%, three phase, four wire.
b. Frequency: 60 Hz ± 2.0%.

The power function within the VSCS switching equipment shall meet the load balance specified in 3.3.2.3.1 of FAA-G-2100. The power function within the VSCS switching equipment shall meet the power factor specified in 3.3.2.3.2 of FAA-G-2100.

3.9.7.2 VSCS Common Console Equipment (VCE) - The VCE shall operate from the PCS as follows:

a. Voltage: 120 VAC ± 10%, single phase or
208 VAC ± 10%, single phase

b. Frequency: 60 Hz ± 2.0%.

The power source is a critical resource, and the VSCS design must be such as to minimize energy consumption; the VSCS design shall limit power consumption of the common console position equipment to 510 watts per console.

The power function within the VCE shall independently meet the power factor specified in 3.3.2.3.2 of FAA-G-2100.

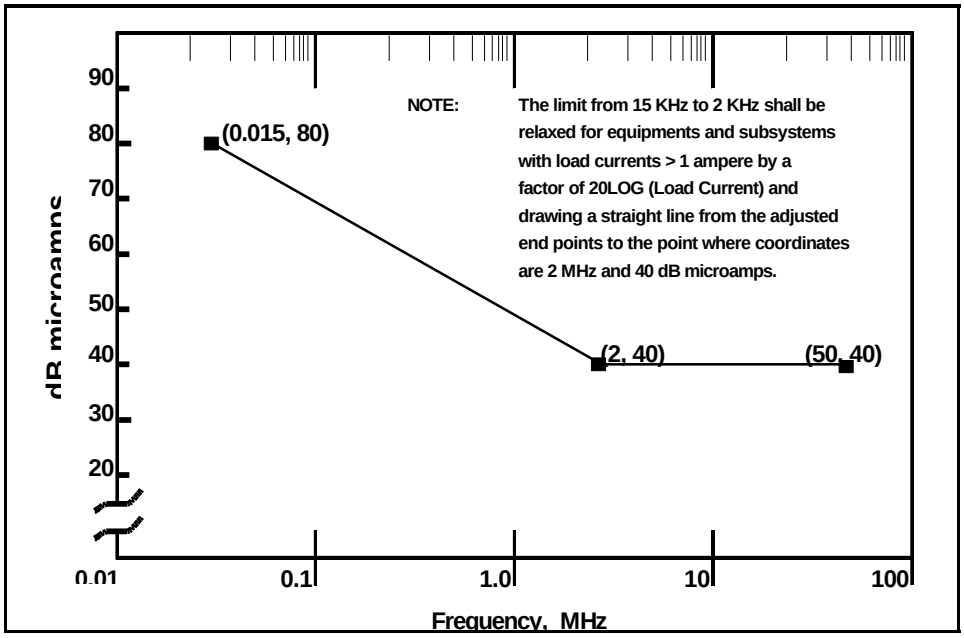

Figure 3-2. Limit for CE03 Narrowband Emissions AC, DC and Interconnect Leads

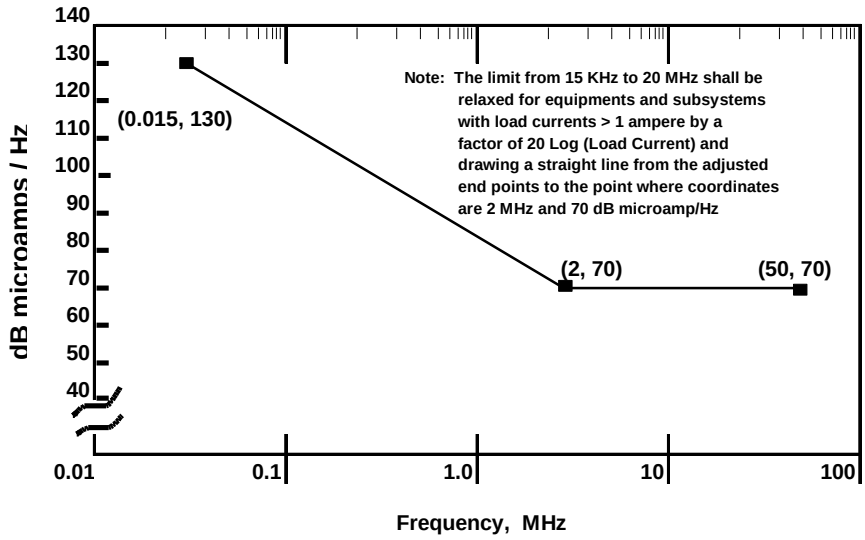

Figure 3-3. Limit for CE03 Broadband Emissions AC, DC and Interconnection Leads

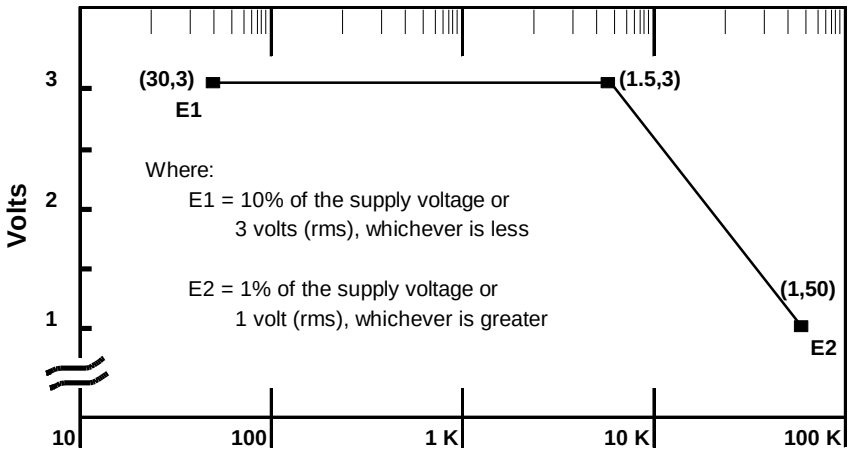

Figure 3-4. Limit for CS01

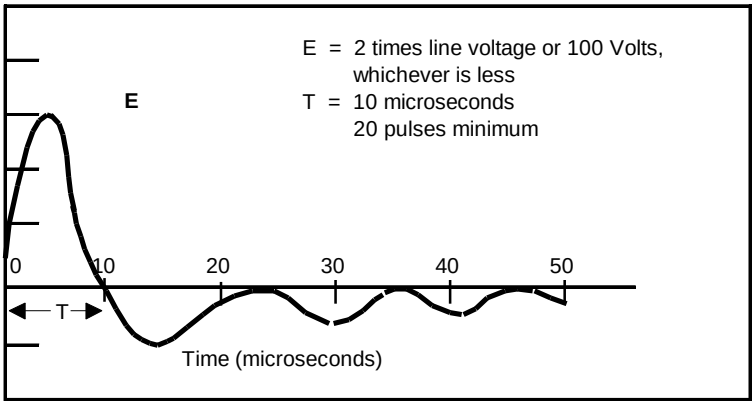

Figure 3-5. Limit for CS06

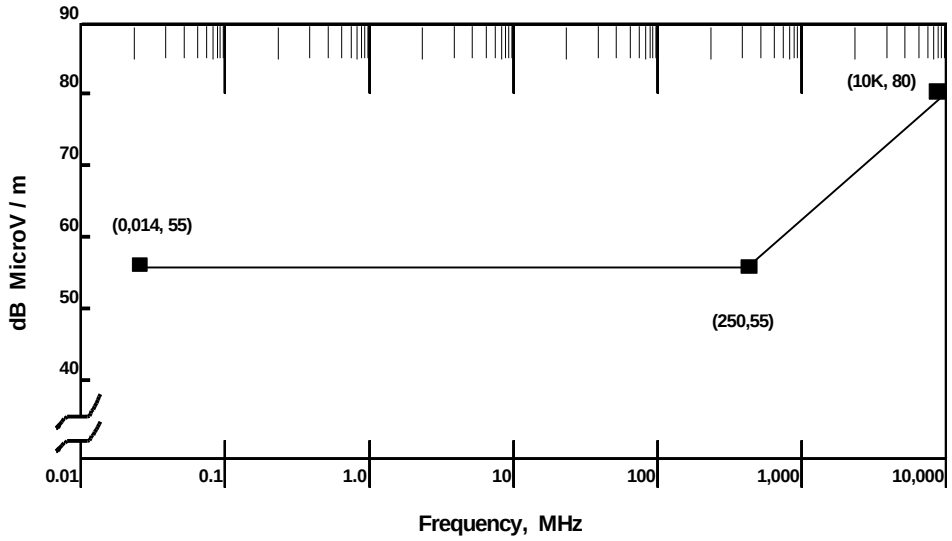

Figure 3-6. Limit for RE02 Narrowband Emissions

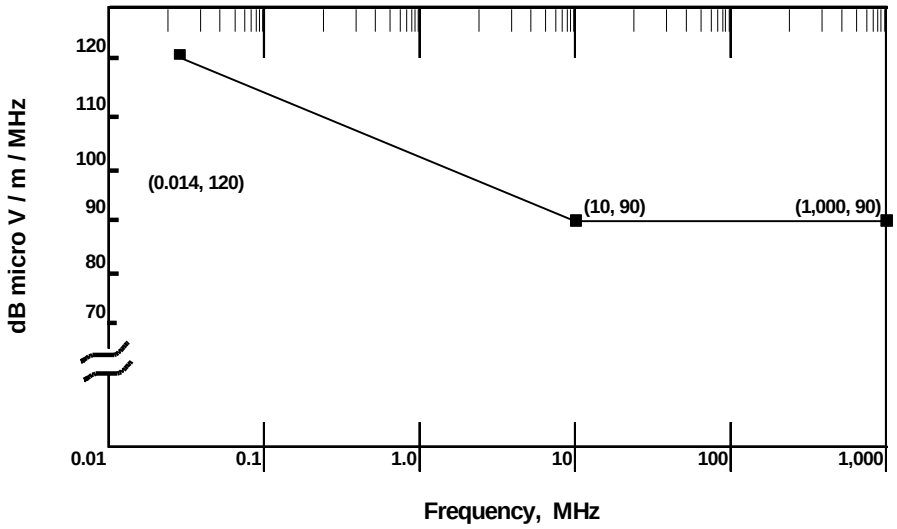

Figure 3-7. Limit for RE02 Broadband Emissions

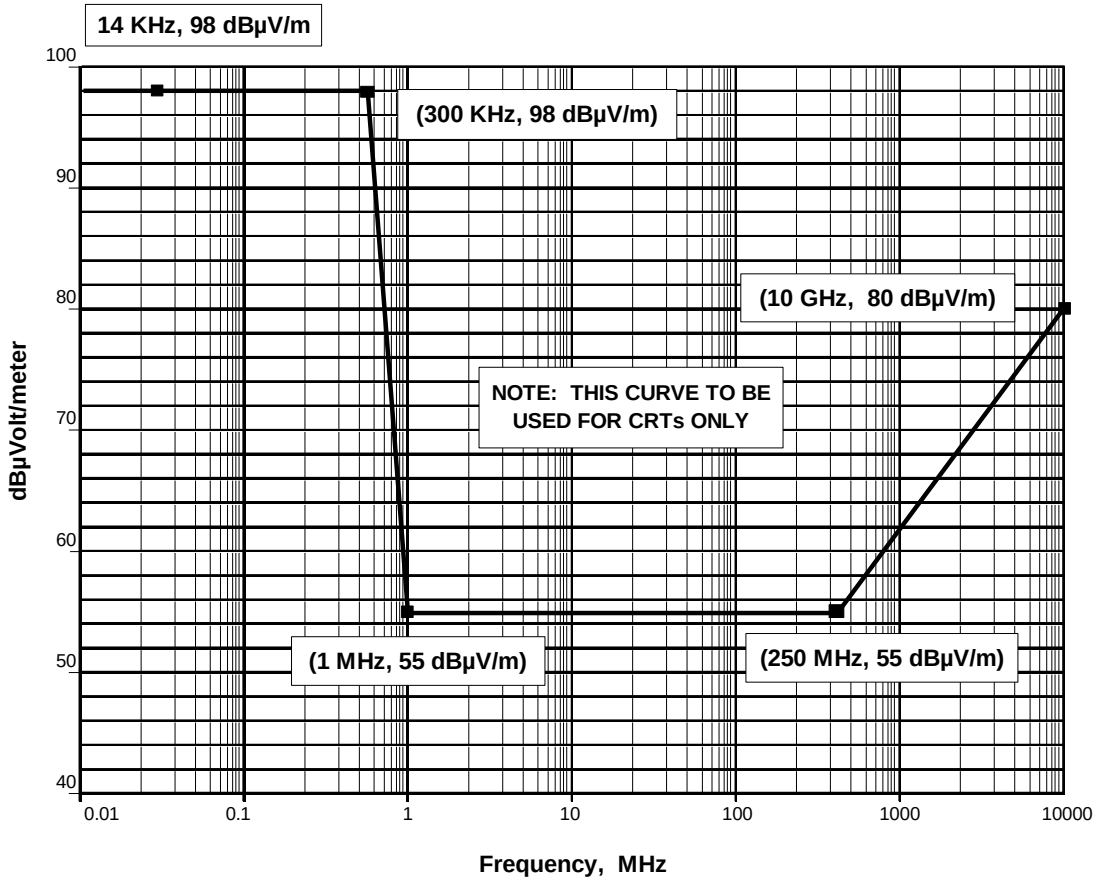

Figure 3-8. RE02 Narrowband Emission Limits for CRTs

3.9.7.3 VSCS Site Power - The VSCS shall be capable of operating from unconditioned commercial AC line power as defined in FAA-G-2100.

3.9.7.4 RESERVED (See Addendum 1)

3.9.8 Power Distribution

The AC power shall be distributed to the VSCS in a dual critical AC busing arrangement. The power supplied to the VSCS switching equipment will be uninterruptible, 120 VAC, single-phase, or 208 VAC, three-phase and will be regulated by the VSCS internal power supplies. The power supplied to the VSCS console equipment will be uninterruptible 120 VAC or 208 VAC, single-phase, and will be regulated by the VSCS internal power supplies. The busing arrangement shall provide dual AC/DC power distribution to all VSCS equipment. The power shall be routed through two independent power paths physically separated to approach the equipment from opposite directions, such that a failure or obstruction of one AC/DC power bus will not disrupt AC/DC power on the other bus. Power distribution design and implementation shall be in accordance with National Electrical Code, NFPA-70, and FAA-C-1217.

3.9.9 Electrical Service Conditions, Transient State

The VSCS shall conform to FAA-STD-020, pertaining to Transient Protection Requirements. No false operational or output signals shall be generated by transients within the defined limits or by inrush currents caused by the VSCS.

3.9.10 Startup Surges

The peak inrush current during startup shall not exceed five times the normal peak operating current. The duration of the inrush operating current shall not exceed 50 milliseconds. The duration is defined as the time from input power application to the time at which the power returns to its steady state.

3.9.11 Power Supplies

Each power supply shall have front panel test points for measuring voltage outputs. Each power supply shall have a front-panel AC circuit breaker that can also be used as an ON-OFF switch during maintenance activities. The VCE ON-OFF switch should be located out of the controller's normal range of motion to prevent accidental activation. Each power supply shall contain electronic circuitry to prevent damage caused by external short circuits. The power supply shall recover immediately upon the removal of external short circuits. The electronic short circuit protection circuit shall allow removal or addition of electronic modules of capacitive loads to be switched ON without causing any circuit protection devices to operate or induce any other side effects. Each power supply shall include circuitry to activate a remote alarm at the maintenance position. Power supplies shall allow power-on installation or removal of VSCS plug-in assemblies without degradation to the VSCS or any VSCS assembly.

3.9.12 Converters and Regulators

3.9.12.1 AC-to-DC Converters and Voltage and Current Regulators - AC-to-DC converters and voltage and current regulators shall be designed so that the system meets the availability requirements of 3.2.3, and the reliability and maintainability requirements of 3.7, specifically the requirement on single-point failures of 3.7.2.

3.9.13 Powerline EMI Reduction Requirements

EMI powerline filters shall be used whenever necessary to eliminate powerline-conducted emissions, in accordance with MIL-STD-461, Part 1, 4.3.1, and conducted susceptibility. All interconnections between the VSCS and external systems shall be shielded in accordance with Section 6 of FAA-STD-020. Emphasis shall be placed on equipment interconnection design and layout to reduce undesirable equipment interactions. Equipment that is susceptible to or is a source of radiated EMI shall comply with the requirements of 3.9.5.4.

3.9.14 Grounding Systems

3.9.14.1 General - The FAA will furnish the earth ground and the AC power ground at all installations. Grounding systems shall be in accordance with an approved grounding plan. Grounding systems shall be designed to prevent cross-coupling through the ground system. Centrally located, grounding shall be used to prevent ground loops and shared impedance-coupling paths. The VSCS shall use separate grounding networks as necessary for; (a) AC, (b) chassis, (c) signal, and (d) trunk circuit. These grounding networks shall be terminated on a grounding terminal block for either strap connection and/or further connection to the earth, AC, and signal grounds. Chassis and signal ground may be combined and logic/control monitor ground may be applied at the cabinet level for commercial equipment. VCE chassis and signal grounds shall be connected with a removable jumper.

Grounding shall be in accordance with Section 3.8 of FAA-STD-020.

3.9.14.2 AC Ground - A common ground derived from the AC power source shall be used for all AC power in the system.

3.9.14.3 Chassis Ground - All surfaces of front panels, chassis, frames, and cabinets shall be at a common chassis ground potential. The chassis ground for equipment located at operating positions shall be obtained from the chassis ground system.

3.9.14.4 Signal Ground - The VSCS shall provide a signal ground for control, monitoring, and logic type signals.

3.9.14.5 Communications Trunk Circuit Ground - Communications trunk circuit equipment shall have a separate ground system. When interfacing with common carrier facilities, this ground shall be connected to their grounding system.

3.9.15 Position Equipment Divided Power Connections

Power connection to VSCS display panels and console equipment shall be wired from two opposing directions from outside the console. Power distribution within the room shall be physically separated to approach the equipment from opposite sides and shall originate from separate dual source AC power system branch circuits (See 3.9.11).

3.9.16 AC Line Receptacle and Power Cord

All receptacle and power cords shall be in accordance with 3.3.2.1.4 of FAA-G-2100.

3.10 SOFTWARE

3.10.1 Software Categories

The VSCS software architecture allocates VSCS functions in three major categories: (a) system software, (b) applications software, and (c) support software. System functions shall include capabilities that apply across the VSCS; capabilities that are common to many or all of the functions; and capabilities that provide for the development, generation, utilization, and maintenance of various computer programs. All stored programs executed by a processor or controller, regardless of implementation technique, shall be considered as software.

3.10.1.1 System Software

3.10.1.1.1 Operating System - The operating system and associated software shall provide the following capabilities.

3.10.1.1.1.1 Real-time Executive - The operating system shall provide a mechanism to schedule and cancel tasks, provide data transfer mechanisms between tasks, and process external and time-based interrupts.

3.10.1.1.1.2 File Management Facility - The system shall provide mechanisms for locating files and for accessing, locking, and updating file information at the record level.

3.10.1.1.1.3 Command File Procedures - The system shall provide a mechanism for executing files containing procedural sequences of operating system commands and utilities.

3.10.1.1.2 Utilities - The system shall provide utility libraries and modules that include the following items.

3.10.1.1.2.1 Data Management Libraries - Data management libraries shall include modules to sort databases on multiple keys, retrieve data from files based on multiple keys, and cross reference data in two files based on a single key.

3.10.1.1.2.2 Mathematical Libraries - Mathematical libraries shall include procedures to perform standard mathematical tasks that are required by VSCS functions, such as RTQC.

3.10.1.1.2.3 Menu Generation Capabilities - The system shall provide mechanisms for constructing menu definitions and for interfacing these definitions with a high-level programming language.

3.10.1.1.2.4 Compilers/Assemblers - The system shall provide compilers/ assemblers and a set of commands that is necessary to facilitate compilations and/or assemblies of computer software. Compiler/assembler functionalities include those capabilities for loading and executing or recording compilations and/or assemblies. The system shall provide mechanisms to help in checkout and in troubleshooting existing programs.

3.10.1.2 Applications Software - All of the applications software functions shall incorporate, to various degrees, software that is unique to their specific objectives, such as call processing and RTQC. This unique software may support one or more of the functional areas. Except as otherwise specified, the unique applications software shall be based on existing, demonstrated technology.

3.10.1.2.1 Application Functions - The VSCS application functions shall include: (a) display function, providing human interface; (b) switching function, performing the connectivity functions and call processing; and (c) control function, providing services including data handling and control, RTQC, and reconfiguration. A detailed description of each function is included in 3.4 and 3.5.

3.10.1.3 Support Software - Support software shall be called upon when the system requires a special report and when priorities and available system resources permit. The special support includes hardware diagnostics, test, simulation, RTQC, and reconfiguration support.

3.10.2 Software Planning, Design, and Implementation

The following paragraphs provide requirements for the attributes of the VSCS software and the characteristics of the software design and development technique. VSCS software development and documentation shall be conducted in compliance with the requirements of DOD-STD-2167. Defense System Software Development, and the requirements herein. The primary objectives of these requirements are to ensure correctness, reliability, efficiency, modularity, and maintainability of the software and to adequately plan and execute the software development process.

3.10.2.1 Software Design - All VSCS software shall be designed in accordance with DOD-STD-2167 and the requirements in this specification. The software design shall accommodate the following requirements:

a. Identical software, adapted to the local resources, environment, and workload shall be installed at each site. Local "patches" to executable code and data tables shall not be used to meet this requirement,

b. Design emphasis shall be placed on reliability, error detection, fault tolerance, and recovery from abnormal conditions. Techniques used to meet this requirement may include, but are not limited to, formal verification of critical software, continuous checking for data consistency, redundant software for essential functions, and duplicate storage of data and programs,

c. The software design shall provide logical and physical data independence. Changes made to the logical structure of the data shall not impact the application programs. Changes made to the physical structure of the data shall not impact the logical structure of the data or the application programs. The VSCS shall permit changes to both the form of storage and to the position of data in the storage medium without impact to the application programs or the logical structure of the data,

d. The software design shall ensure that the system is initialized to a correct, well defined state upon recovery from a fault and that all processing interrupted by a fault is properly continued after recovery,

e. The software design shall incorporate the commercially available operating system(s) that is applicable to the processing elements and consistent with the selected design and architecture for immediate installation, together with commercially available compiler, loader, librarian, and other debug and utility tools.

3.10.2.1.1 Unit Attributes - The software design shall be functionally and operationally modular to:

a. Facilitate system expansion, modification, and configuration control,

b. Enhance system reliability by facilitating fault detection, diagnosis, containment, recovery, and fault-tolerant behavior,

c. Facilitate database changes to the lowest practical level without large program reassemblies.

3.10.2.1.2 Design Representation - The design shall be represented in a manner that facilitates traceability to the specification, ease of understanding, and ease of design implementation. The representation shall be maintained as part of the design database. The design representation for the VSCS can be any available Program Design Language (PDL) that satisfies the following requirements:

a. Provide a natural expression of the control constructs specified for code development,

b. Be compatible with the properties and facilities of the target language candidates and their automated tool implementations,

c. Facilitate a precise specification of the design and impose a rigorous structure on the design,

d. Be directly processable by the tools specified herein to facilitate the analysis provisions noted and to enable automated standards enforcement to be accomplished,

e. Be comprised of successive, independent levels of abstraction with an independent set of objects and the operations on these objects defined at each level,

f. Explicitly document design decisions with high-order decisions not affected by low-level implementation,

g. Be expressed in such a way that programmers receive only that information needed to complete a unit and users receive only that information needed to use a unit,

h. Provide formal, testable unit specifications with design decisions decoupled and encapsulated, interfaces explicitly defined, and complete documentation of dependencies,

i. Permit only procedures within a unit to access the data of that unit, while restricting other units to access that data only through the interface provided by those procedures,

j. Allow only functional interfaces to be shared by users and providers, with users seeing only abstract properties.

3.10.2.1.3 Special Tools and Techniques - Automated design support tools shall be used to record, analyze, and maintain the VSCS software design. These tools shall provide:

a. Traceability of software system components to software requirements,

b. Completeness and consistency testing of all software units,

c. The means to verify adherence of the design to software design standards,

d. The means to indicate in the design representation that a design feature is incomplete and to later identify and track all such incomplete design features,

e. Various printed outputs such as source listings, error lists, cross-reference lists, flow charts, hierarchy charts, design changes, history logs, etc.

The tools shall be applicable throughout the software development and maintenance life cycle. They shall address all aspects of operational software design including algorithms, data structures and files, and interfaces. The tools shall encourage and facilitate design of software in accordance with FAA-approved design techniques and standards.

All tools used during software design, and needed for software maintenance, shall be delivered to the FAA.

3.10.2.2 Software Implementation - All VSCS software shall be developed in accordance with programming standards approved by the FAA. These standards shall include the use of modern structured programming techniques, unit and variable naming conventions, readability, and the use of descriptive comments.

All software documentation shall be in accordance with FAA-approved standards. All off-the-shelf software shall meet the documentation standards. Any waiver from the above requirements shall be justified and submitted to the FAA for approval.

3.10.2.2.1 Unit Attributes - All units shall have the following additional attributes:

a. All source codes shall be indented to clearly denote logical levels of constructs,

b. Non-executing statements shall be grouped and arranged in a meaningful order in the code, e.g., columnar rather than a horizontal string,

c. Data declarations shall be grouped and arranged in a meaningful order in the code, e.g., columnar rather than a horizontal string,

d. Data names and procedure labels shall be meaningful,

e. Each line of source code shall contain one statement only,

f. Formats for error and diagnostic messages shall be standardized and shall require no additional interpretation such as table lookups,

g. Loop indexes shall not be altered during loop execution,

h. Unnecessary assignment of a constant value to a variable (especially within a loop) shall not be made,

i. Units shall not share temporary storage locations of variables,

j. Complicated expressions, such as compounded negative Boolean expressions, and nesting beyond three levels shall be avoided.

3.10.2.2.2 Special Tools and Techniques - Automated tools shall be used to support the software development process. These tools shall provide or facilitate the use of:

a. Software configuration management,
b. Common data type definitions and procedure libraries,
c. Cross-reference listings and indices,
d. Reformatted program source text to provide a uniform and consistent style,
e. Measurement of program size and complexity,
f. Unit interface checking and identification of other program anomalies,
g. Unit testing and debugging facilities, including data recording and reduction,
h. Compilation, linking, and loading,
i. Data management,
j. Verification of adherence to software programming standards.

All tools used during software implementation shall be delivered to the FAA for software maintenance.

3.10.2.3 Design Language, Tools, Development Aids and Higher Order Language - All software detailed designs and codes shall be expressed in VSCS standard language. The standard for detailed design shall be a text-processor PDL, which incorporates selected design features, such as modularity, packaging, information hiding, and data abstraction. The PDL shall be used to promote transportability. Other software development tools, including those for configuration management, data management, and real-time applications shall be evaluated and selected, and described in the related documents.

3.10.3 Software Reliability - VSCS software shall have the following reliability characteristics:

a. **Fault avoidance.** The software shall be specified, designed, and implemented to achieve high reliability in accordance with the detailed software design and construction requirements presented in 3.10.2.

b. **Fault detection.** The VSCS shall have the capability to detect its own software-induced failures. Software fault detection techniques used in the VSCS shall provide for detecting software failures in sufficient time to permit recovery of all functions that the software supports within the response-time thresholds specified for the functions.

c. **Fault tolerance.** The software shall provide fault-tolerant mechanisms that ensure continuing required functions without causing an interruption in service. These techniques may include, but are not limited to: (a) recovery block schemes (which cause switching to a spare block of code), and (b) protective redundancy (which includes multiple storage of critical variables and data, diagnostic program, and automatic program reloads).

d. **Fault containment.** The following fault containment considerations shall be incorporated into the VSCS software design:

1. The software design shall prevent the propagation of software errors. No information shall be passed unless error boundary conditions are satisfied.

2. The system shall be designed to protect itself against errors in operation or data that may be introduced as the result of incorrect synchronization of software. For example, the VSCS should have a protection or fault data logger on in case of running out of “tape”, or no communication line available.

3. Only explicitly specified sharing and exchange of information among software units (modules) shall be permitted.

3.11 SECURITY AND SAFETY

3.11.1 Security

The security requirement on the VSCS shall be in accordance with FAA Order 1600.54, Security of FAA Automatic Data Processing Systems and Facilities.

The VSCS shall protect all information within the system. It shall protect as a minimum, data, data stores, and hardware components from unauthorized manipulation and shall provide user access verification. The VSCS shall ascertain user authorization for system entry and ensure that unauthorized users are precluded. All system entries and attempted entries shall be reported to a designated supervisory position.

3.11.1.1 RESERVED

3.11.2 Safety

The VSCS system shall be compliant in all aspects with OSHA Safety and Health Standards (29 CFR 1910). System safety engineering principles shall be applied throughout the design, development, manufacture, test, checkout, operation, and maintenance of the VSCS, in accordance with the following requirements of MIL-STD-454:

a. Requirement 1: Safety (Personnel Hazard),
b. Requirement 3: Flammable Materials,
c. Requirement 8: Electrical Overload Protection, Class 1 Equipment,
d. Requirement 45: Corona and Electrical Breakdown Prevention.

3.12 TRANSITION REQUIREMENTS

3.12.1 Operational Redundancy

The VSCS shall be designed, installed, integrated, and tested in such a way that it is operationally redundant with the existing FAA systems that it will replace.

3.12.2 Transition Equipment

A transition switch shall provide switchover between the VSCS and the existing communications equipment to access the G/G IP/PABX trunks, the A/G radio audio and control (Radio Control Equipment (RCE), BUEC, and existing radio interfaces) and the Legal Recorders. The switchover shall be on a line-by-line basis for testing and as a whole for transferring ATC communications operations. Special interface equipment shall be provided as necessary to ensure continuing operation of the existing communications equipment as interim provisional backup for VSCS operations. The transition switch shall provide for complete access to the existing communications equipment or the VSCS and its interfacing equipment(s), as selected by ATC operations personnel.

Transition Switching of all paths of either the VSCS or existing communication system shall be manually initiated from a single remote control point which shall be capable of being located up to 1000 feet from the transition switch equipment. The transition switch shall also have a local point of control at the switch. The designation of the point of control (local or remote) shall be under key security.

Switchover between the VSCS and existing communication system shall be completed within one (1) second. Visual indication of whether the switchover was successful or unsuccessful shall be provided at the local and remote control point.

3.12.3 Communication System Availability

The total communications capability of the existing switching system and the FAA radio control system shall be available for ATC operations at all times during the installation, integration, acceptance testing, cutover, and during operation of the VSCS, as provided by the transition equipment specified herein, except for the time that individual positions are released for installation of VSCS equipment(s). The transition switch equipment shall be capable of installation and removal without degrading the performance of the VSCS or existing communications system.

3.13 RESERVED (See Addendum 1)

4.0 QUALITY ASSURANCE PROVISIONS

The VSCS shall be produced in accordance with Quality Assurance (QA) provisions that provide continuing system verification throughout the VSCS procurement program. These provisions shall ensure that engineering design and development are complete, the design risks are minimized, and that all delivered hardware, software, and documentation meet specified requirements. The quality assurance provisions shall also ensure that the methods of design, construction, inspection, and testing provide early detection of deficiencies and assure prompt, effective corrective action.

Formal Quality Assurance plans and procedures shall be applied to the VSCS system. The quality program shall include a hardware quality control system to monitor all materials and equipment, and a software quality control system to monitor all software in accordance with the contract.

In addition, end item and in-process tests shall verify that VSCS hardware and software meet the requirements of Section 3 of this specification. Test programs shall be in accordance with the FAA-approved Contractor Master Test Plan.

4.1 GENERAL

The VSCS quality assurance effort shall cover all hardware and software provided in the system to ensure that appropriate standards for software and hardware design and fabrication are followed and that all subcontractor and vendor items are in accordance with all contract requirements. All quality assurance activities shall be in accordance with Quality Assurance plans. All test activities shall be in accordance with the FAA-approved Contractor Master Test Plan.

4.1.1 Quality Management and Responsibilities

The quality assurance program shall be managed by the contractor and will be reviewed by the Government. The major responsibilities of each of those organizational elements shall be in accordance with the FAA-approved QA plan.

4.2 QUALITY CONTROLS

The quality controls identified in this section ensure the quality of the system hardware and software developed under this program. Throughout the entire VSCS production period, inspections, reviews, and audits will be applied on an ongoing basis to ensure the quality of the product.

Formal testing will be used to verify that the design(s) meet the requirements of this specification. These tests will be conducted at subcontractor, prime contractor, and FAA facilities. Tests by the subcontractor and contractor will demonstrate adherence to specifications and verify readiness for delivery. Tests by the FAA will verify acceptability of the system and assess operational usability.

4.2.1 Hardware Quality Control Program

The hardware quality control system shall be in accordance with FAA-STD-016, Quality Control System Requirements. The hardware quality control system shall provide for inspection and testing according to written standards of quality that specify definitive, measurable criteria to enable such inspections and tests to confirm compliance with these standards and assure that all delivered materials and equipment meet contract requirements. Included are control of purchased material procedures to ensure the acceptable quality of subcontractors' and other suppliers' equipment, and test control procedures for each configuration item to ensure the validity of all tests and results.

The hardware Quality Control plan shall include quality assurance activities related to the review and audit requirements of MIL-STD-1521 and the contract. The plan shall also address hardware documentation quality control in accordance with Section 1.4 of FAA-D-2494/b. Hardware configuration management shall be in accordance with FAA-STD-021.

4.2.2 Software Quality Control

The software quality assurance program shall be established and maintained in accordance with FAA-STD-018. The software quality assurance program shall provide for reviews and audits, and testing of all software throughout the contract period to ensure that all software and documentation meet contract requirements. Software configuration management shall be in accordance with FAA-STD-021.

Written standards of quality shall be established that specify definitive, measurable criteria to enable inspections and test to confirm compliance with these standards and assure that software meets contract requirements. Included are controls to be applied to software documentation, to test documentation, and to other documentation.

4.2.2.1 Software Stability Tests - The operational software shall be tested in as realistic an environment as is possible in the factory. During the functional testing of the operational system, software stability shall be ensured over a 7-day period of continuous 24-hour/day operation. These measurements shall determine that system halts or instabilities that may indicate marginal operation (e.g., approaching saturation limits of input/output (I/O) buffers) do not occur at a frequency that will preclude operational use of the system. The following requirements shall be followed for the stability tests:

a. Hardware faults shall be corrected and retested. A test fault shall be determined to be software if it can not be demonstrated to be a hardware fault or due to an out-of-tolerance power condition.

b. Intermittent hardware faults must be demonstrated to be hardware and corrected or they will be logged as software faults. Software faults shall include anomalies in test results from test procedures and all console software error messages that occur during testing. Console error messages that indicate marginal system operation such as I/O buffer shortage, operating system time outs, or others shall be logged as software faults.

c. Software faults shall be categorized as system or simple, and repeatable or nonrepeatable. A system fault is one that causes the system to be unavailable to any one position or to the VSCS external interface for more than 10 seconds. Unavailable means that the system does not respond to attempted inputs from that interface. Simple faults are all software faults that are not system faults.

d. Repeatable system faults shall be corrected and retested. Repeatable simple faults shall be logged and isolated to the appropriate software unit/module. Repeatable simple faults shall be corrected and retested. The FAA shall have the option of continuing testing or requiring correction before resuming testing.

e. The stability of the operational software shall be measured. The measure of stability shall be the number of system faults and the number of nonrepeatable simple faults that occur over a 7-day period of continuous running of the operational system. If any system faults or ten nonrepeatable simple faults occur during this time, the test results shall be considered unacceptable. The software problems shall be isolated and corrected and the stability test rerun.

f. Stability tests shall be conducted with at least 100% of the traffic load provided by the Contractor Traffic Simulation Unit (CTSU) to the entire system. Any deterioration of audio quality caused by the stability tests shall be investigated, corrected, and retested.

4.2.2.2 Software Stress Tests - Software stress tests shall include unexpected or extreme conditions as follows:

a. Erroneous inputs.
b. Maximum or overload processing demands.
c. Simulated failure of software and induced failure of hardware components.
d. Unexpected conditions that may occur in the operational environment.

4.2.2.3 Test Results - The software test results shall identify the following:

a. Nominal behavior of the software,
b. Range of functions that can be accomplished successfully by the software,
c. Errors in the software,
d. Special cases requiring additional testing,
e. Ability to survive erroneous inputs,
f. Ability to meet voice intelligibility (3.4.2.3.8.4) and voice delay (3.2.2.2.28) requirements.

4.2.3 Design Reviews and Configuration Audits

The VSCS design shall be reviewed and audited at key points during the contract, following MIL-STD-1521 to assess the progress of the development process and the quality of the evolving system.

4.3 RESERVED

4.4 RESERVED

4.5 DEVELOPMENTAL TESTING AND EVALUATION (DT&E)

The VSCS hardware and software shall be developmentally tested and evaluated to assist the engineering design and development process and to verify attainment of technical performance specifications and objectives. The VSCS DT&E shall be based on a bottom-up building-block approach that takes a well defined subset of VSCS requirements and validates compliance of that building block with its requirements before proceeding to the next higher level of integration. Major test series shall progress from the unit level, to the subsystem level, combined subsystem and, finally, up to the system test level. Functional capabilities of each successive building block shall increase until the final building block implements all VSCS requirements. In the event of test failure, repeat testing shall be conducted. Regression tests shall be introduced after software or hardware changes have been implemented.

4.5.1 Test Classification and Levels

The tests to be conducted during the DT&E shall be classified as hardware tests, software tests, and integration tests. The hardware tests shall be conducted at the unit, subsystem and system levels and the software tests at different Computer Software Component (CSC) and Computer Software Configuration Item (CSCI) levels. The integration tests shall be conducted at the unit, subsystem, combined subsystem, and at the system level as specified below.

4.5.2 Hardware DT&E

4.5.2.1 Unit Tests - Functional units of the hardware shall be inspected and tested for conformity with the physical characteristics of design and construction as specified in 3.9. Also, the tests shall verify the functionality and performance requirements allocated to the unit in accordance with this specification.

4.5.2.2 Subsystem Tests - Hardware subsystem level tests shall verify input/output (I/O); communications between functional units; timing and synchronization, and the physical, environmental, and EMC characteristics of 3.9.

4.5.2.3 System Tests - Total hardware system level tests shall verify that:

a. All functional units perform in accordance with applicable hardware requirements when integrated and interconnected, and

b. Interfaces between functional units of the VSCS operate according to hardware interface requirements prior to integrating hardware with software.

4.5.3 Software DT&E

The software unit (CSC) and subsystem (CSCI) shall be tested to verify as a minimum, unit processing and timing, and CSCI functional assembly, software timing, inter-CSCI communication, and stress testing.

4.5.4 Integration DT&E

4.5.4.1 Unit Functional Demonstration - Hardware and relevant software shall be integrated to demonstrate allocated functionality, performance, throughput timing and the outputs, products, and reports generated at the functional unit level.

4.5.4.2 Subsystem Integration Testing - Hardware subsystem shall be integrated with CSCI and tested at various loads up to the maximum loading conditions to determine functionality and performance characteristics. The test shall also verify error recovery and the output products and reports at the subsystem level.

4.5.4.3 Combined Subsystem Testing - Integrated subsystems shall be tested in combinations to verify I/O, intersubsystem communications, and synchronization. Human factors testing shall be conducted at this level as appropriate. The retesting of individual subsystems is required when the combined subsystems do not work together.

4.5.4.4 System Level Testing - After the successful conclusion of combined subsystem testing, the system shall be integrated and tested to verify that it meets the requirements for all functions, human factors, performance, RMA, environmental, EMC, error recovery, reports, and products at various load levels up to the maximum load.

4.5.4.5 Simulation Equipment - The contractor shall use the voice traffic and interface simulation equipment developed during the VSCS prototype development phase to simulate ATC traffic loads during testing. The Traffic Simulation Unit (TSU) shall provide loads up to 200% larger than those specified in Tables I and II.

4.6 RELIABILITY AND MAINTAINABILITY DEMONSTRATION TESTS

4.6.1 System Reliability Demonstration Test

The reliability performance demonstration of the VSCS shall be at least 360 hours at PBH traffic load in accordance with Table II. Preventive maintenance tasks, when required during the reliability demonstration test, shall comply with all preventive maintenance requirements of this specification. Testing shall be performed at an ambient temperature of 25 ± 5 degrees C, with voltages and frequency in accordance with the service conditions of this specification. All test documentation requirements of this specification shall apply to the reliability demonstration test.

4.6.1.1 Reliability Demonstration Test Log - A chronological test log shall provide the dates and times of all significant events. Events that must be recorded are:

a. Power on and off times of each equipment or equipment group,

b. Start and stop times of demonstration testing,

c. Functions, modes and phases of tests, including random tests,

d. All interruptions of tests, including all failures,

e. Failure report numbers (logged at time of failure),

f. Time to restore each failure, including specifically: diagnosis time, repair-replace time, and checkout time (including recalibration, reprogramming, reverification, etc.),

g. Continuous temperature recording of test area,

h. Any unusual conditions in equipment under test, auxiliary equipment, source power, or environment.

4.6.1.2 Reliability Demonstration Test Report - A reliability demonstration test report shall summarize all test results obtained during the tests, and shall provide in detail the rationale and calculations of demonstrated reliability of each operational position. The report shall also include the cumulative failure summary report and a copy of the reliability demonstration test log.

4.6.2 System Maintainability Demonstration Test

Corrective Maintenance and Preventive Maintenance (PM) demonstration tests on VSCS equipment shall be on the first production system.

4.6.2.1 Corrective Maintenance Test - The corrective maintenance demonstration shall be in accordance with MIL-STD-471, except as modified in this paragraph. The task selections shall be as stated in Appendix A of MIL-STD-471. The statistical corrective maintenance tasks shall have failure modes statistically chosen. Test Method 8, Plan A1 plus Plan B1 of MIL-STD-471, shall be used for all corrective maintenance tasks. These tests shall be tailored to include the more stringent test level imposed by the availability requirement of .9999999.

4.6.2.2 PM Test - The PM demonstration on the VSCS shall be in accordance with FAA-approved maintenance. The FAA will select PM tasks contained in the approved procedures to be performed during the PM demonstration test. The total number of tasks shall be the same as those contained in the instruction manuals. The procedures shall also list the recommended frequency at which the tasks are to be performed and the time required to perform these tasks. Equipment required for operational (on-line) use shall not be preempted for PM. The ability to perform PM without degrading system performance shall be demonstrated.

4.6.2.3 Maintainability Demonstration Test Log - A chronological test log shall provide the dates and times of all significant events. The following is a list of events that must be recorded:

a. Power on and off times of each equipment or equipment group,
b. Start and stop times of demonstration testing,
c. Functions, modes, and phases of tests, including random tests,
d. All interruptions of tests, including all failure details,
e. Any unusual operating conditions.

4.6.2.4 Maintainability Demonstration Test Report - A maintainability demonstration test report shall be in accordance with the schedule. This report shall document the results of the test. It shall provide the detailed calculations of the demonstration maintainability of each subsystem. The report shall also include a copy of the maintainability demonstration test log.

4.7 TEST EQUIPMENT

For tests conducted on site, all necessary test equipment shall be delivered to the FAA on time, calibrated, and fully operational to support all tests. Use of FAA test equipment may be possible where this test equipment is on site and is available and meets all specified test equipment requirements. All test equipment used during the factory or site tests shall be standard commercial equipment and shall not be modified. The test equipment shall operate in the manner specified by the test equipment manufacturer. Use of custom test equipment or modified commercial test equipment requires approval in writing by FAA. Recalibration of test equipment used in the test program may be required due to the following:

a. The test equipment is removed from the test setup for unrelated purposes,

b. The test equipment fails or is damaged, or seems to be operating in a faulty manner based on FAA evaluation of test results.

4.8 RETEST

The reasons for all failures and noncompliances shall be determined. All corrective action necessary shall be taken to ensure full specification compliance. All repair or rework shall be completed prior to submission for retest. The FAA will determine the extent of retest required. No retest shall be started until all documentation has been submitted concerning the noncompliance and the corrective action taken, and the FAA agrees to start the retest. If a review of the reasons for failure to comply with specification requirements indicates that the cause may exist as latent defects in items previously accepted, the defects in all units shall be corrected in a timely manner, even those previously accepted by the FAA.

4.9 FACTORY TEST

A complete series of factory tests on the VSCS equipment and software, and on operation and maintenance procedures shall be performed in accordance with FAA-G-2100. These factory tests shall demonstrate that all hardware, software, and performance requirements are met. The factory test procedures shall list all test equipment and test software used. In addition the test equipment shall identify make, model, serial number, and certification data. The procedures shall have detailed step-by-step instructions with explanatory material to describe what is occurring. Test equipment interconnection with equipment under test shall be explicitly described in graphical and textual form. Functions, data interfaces, and interactions of test software shall also be clearly defined and identified in the test procedures.

4.9.1 Design Qualification Tests

A complete series of design qualification tests on the VSCS shall accomplish two purposes. First, these design qualification tests shall verify that the design is adequate to meet specification requirements for the maximum size system. These tests shall verify that allocated function and performance requirements are fully satisfied. Second, the design qualification tests shall verify that the performance of the equipment and software at all levels of implementation is adequate to warrant commencement of other FAA-witnessed tests.

4.9.1.1 Environmental Qualification tests - Environmental qualification tests shall include vibration screening, thermal/vacuum, and electromagnetic compatibility (EMC). For unmodified subsystems that have completed a qualification process previously, specifications, plans, procedures, reports, and other related documents shall be submitted for approval.

4.9.1.1.1 Vibration-screen and Shock Testing - Vibration-screen and shock testing shall be in accordance with the requirements of 3.9.5.2.1 and 3.9.5.2.2 for untested or modified subsystems and system.

4.9.1.1.2 Thermal/Vacuum Testing - Thermal/vacuum qualification tests shall be required for subsystems and systems that have not undergone such a process, or that have been repaired or modified, after review of test documentation. Those subsystems and systems shall be subjected to qualification tests for temperature, pressure, and humidity as specified in Figure 4-1.

4.9.1.1.3 EMC Testing - Testing on subsystems and systems shall be in accordance with the requirements of 3.9.5.4. Test procedures shall be in accordance with MIL-STD-462, except as noted in the requirements.

4.9.1.2 Throughput Performance Design Qualification - Type-I risk shall be constrained to 5% for the test measurements for throughput performance requirements as stated in 3.2.2, and Table III for the 95% and 99.9% maximum response time values with the event type exceptions stated below. The risk is discussed in 6.2. Event types excluded from Type-I risk are as follows:

a. A/G PTT Transmit
b. System-Generated A/G PTT Transmit
c. A/G PTT Release Transmit
d. G/G PTT Transmit
e. G/G PTT Release
f. IC Call Placement
g. IC Call Acceptance

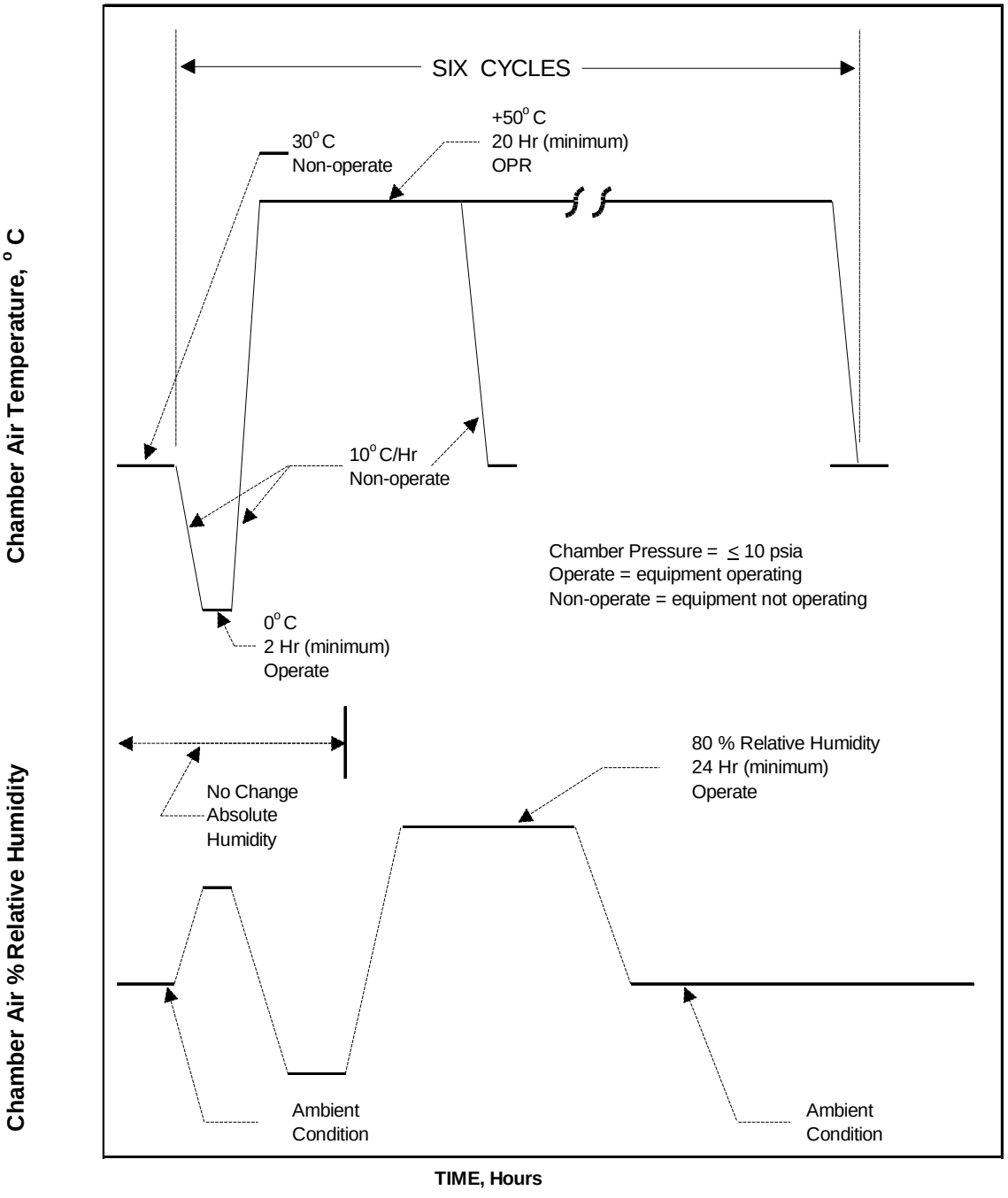

Figure 4-1. VSCS Design-Qualification Thermal Vacuum Test Conditions

h. Position-to-Trunk IP Call Placement for type 9 trunks only
i. Trunk-to-Position IP Call Placement for type 9 trunks only
j. Position-to-Trunk IP Call Acceptance for type 9 trunks only
k. Position-to-Trunk IP OVR Call Placement Response Time
l. Trunk-to-Position IP OVR Call Acceptance Response Time
m. IC OVR Call Placement/Acceptance Response Time
n. Radio Squelch Break
o. Frequency Preemption Activation

4.9.2 Production Tests

A complete series of production tests on all production VSCS equipment to be delivered shall be in accordance with the provisions of this specification. These production tests shall be at the level necessary to demonstrate compliance with specification requirements. In all cases, system-level production tests shall be performed.

4.9.2.1 RESERVED

4.9.3 Type Tests

A complete series of type tests to the system and subsystem level on selected VSCS production equipment shall demonstrate compliance with specification requirements when subjected to the range of service conditions in Table XIV. The service conditions shall include both electrical and environmental and shall be as specified. The equipment selection for the type test and the environmental test procedure shall be in accordance with FAA-G-2100.

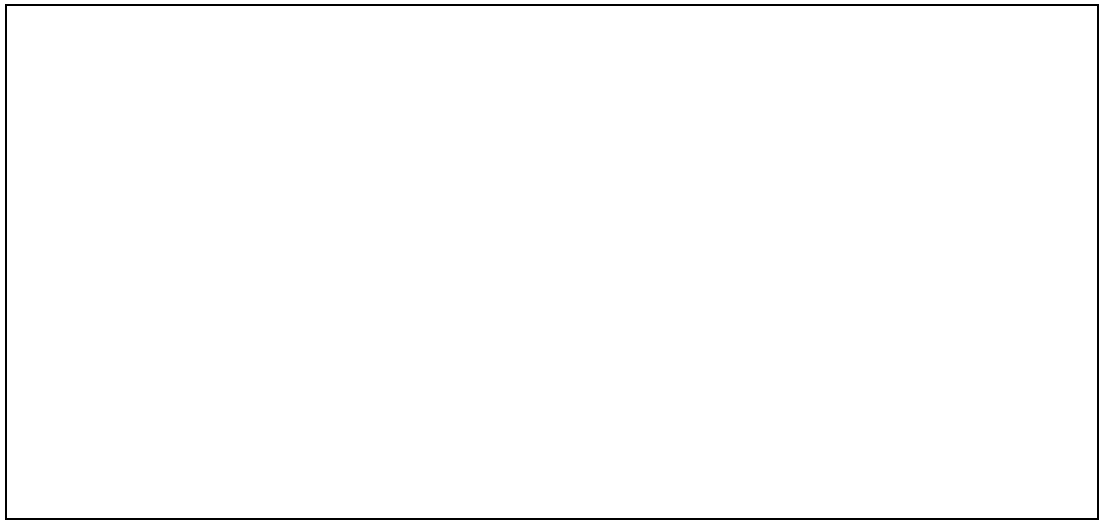

Figure 4-2. RESERVED

4.10 SITE ACCEPTANCE TESTS

A complete series of site tests on the VSCS equipment, including unit diagnostics and system-level tests, shall demonstrate that all system-level hardware and software requirements are met. The site tests shall demonstrate that all external interfaces operate properly and that all requirements can be fully met for both incoming and outgoing data exchange. The site tests shall also demonstrate that the system is fully compatible with and operable in the government-furnished facilities. The site tests shall verify system-level functional and performance requirements, and the site tests shall consist of a selection of the factory tests wherever possible. New tests shall be used where necessitated by the installation configuration. EMC requirements shall be verified in accordance with 3.9.5.4.

4.10.1 Installation and Checkout Tests

The specific approach, methodology, and procedures specified in the installation plan shall be followed during installation of VSCS equipment. Preliminary testing shall verify the correct VSCS installation and connection through the application of power and signal to exercise the entire system.

4.10.2 Site Integration and Acceptance Tests

Site integration and system acceptance tests shall verify that the VSCS, after installation and integration with the GFP systems, meet the requirements of this specification. All hardware and software subsystems shall be integrated into the site and operate properly when inter-connected to GFE system interfaces. These tests shall include verification of the fault tolerance and failure recovery capabilities of the VSCS. Hardware failures shall be induced to verify switchover to redundant or backup equipment and to verify all signal paths within the VSCS are operational.

4.10.3 RESERVED

4.10.4 RESERVED

4.11 QUALITY CONFORMANCE REQUIREMENTS

Each formal test plan shall delineate each specific VSCS requirement to be demonstrated during the test. Included with each requirement will be an indication of the method to be used to demonstrate the requirement, the expected output or results, and how the results will be analyzed to determine success or failure. In each formal test procedure, the requirement identification will be noted at the beginning of the procedure steps which test the requirement. Requirement identification will consist of the number used in this specification.

The requirement identifications called out in the test plan will be noted one or more times within the associated procedure. Each test report will contain a section that delineates all requirements demonstrated during the test followed by an indication of the actual output or results and a statement concerning the success or failure of the demonstration. The Requirements Verification Methods described in 4.12 shall be a living table included and maintained in formal test plans. The corresponding test report for each test plan will include Table XVI updated to reflect the relative completeness of requirement satisfaction and the deviations or liens necessary to proceed to the next level of test activities.

4.12 REQUIREMENTS VERIFICATION METHODS

The following is a methodology used to verify adherence to requirements specified. The verification methods include: Analysis, demonstration, test, and inspection. Each requirement and method of verification shall be presented in tabular form, similar to the sample shown in Table XVI.

4.12.1 Implementation of Verification Methods

These verification requirements shall be mandatory for use in all testing of the VSCS. Where applicable, pass/fail criteria for each verified requirement shall be defined and placed in the appropriate documentation. Failure to "pass" the appropriate verification action(s) (analysis, demonstration, test or inspection) shall be cause for rejection. No adjustments to the equipment shall be allowed during verification. Upon evaluation of the cause of the failure and the implementation of proper corrective measures, the verification in which the failure occurred shall be repeated. If the corrective action has an impact on prior verifications or if a computer program is changed, or if any hardware is changed, then the prior verification shall be repeated. Representative data to prove that an item meets specification requirements may include data collected from previous or other equipment and system verifications. Each verification method is detailed in the following sections.

4.12.1.1 Analysis - Analysis is verification by technical/mathematical evaluation or simulation using mathematical representation (i.e., mathematical models, algorithms, equations), charts, graphs, circuit diagrams, data reduction/recording and representative data to prove that an item meets specified requirements.

4.12.l.2 Demonstration - Demonstration is an uninstrumented test, where success is determined from observation alone. Included in this category are tests whose results can easily be determined on a pass-fail basis.

4.12.1.3 Test - Test is verification, through systematic exercising of the item under all appropriate conditions with collection, analysis, and evaluation of quantitative data for predetermined performance characteristics. Acceptability of the item is determined by the comparison of the data with pre-established quantitative requirements and occurrences.

4.12.1.4 Inspection - Inspection is verification by visual examination of the item, reviewing descriptive documentation and comparing the appropriate characteristics with a predetermined or referenced standard to determine conformance to requirements without the use of special laboratory equipment or procedures.

Table XVI. Requirements Verification Methods

Paragraph	Requirements	Verification Methods
3.1.3	System Design and Construction Features	I
3.1.3.1	A/G Backup switch	A
3.1.3.2	Architecture	ID
3.1.3.2.1	Voice and Data Resource Constraints	AT
3.1.3.2.2	Adaptability	D
3.1.3.2.3	Failure impact limitation	AT
3.1.3.3.1	Two types of VSCS position equipment	I
3.1.4.1	Radio Communication and Control	D
3.1.4.2	BUEC	D
3.1.4.3	G/G Communication	D
3.1.4.3.1	IC	D
3.1.4.3.2	IP	D
3.1.4.3.3	PABX Interface Function	D
3.1.4.4	VSCS Switching Features	D
3.1.4.5	Position Split Functionality Mode Functions	D
3.1.5	Reconfiguration Functions	D
3.1.6.1	Timing and Synchronization	I
3.1.6.2	Power Supply	I
3.1.6.3	Classmarks	AD
3.1.6.4	Numbering Plan	AD
3.1.7	Interface Design Features	AI
3.1.8.1	Backbone Microwave system	ID
3.1.8.2	Leased Transmission Service	ID
3.1.8.3	Telephone Networks	ID
3.1.8.4	Integrated Communications Switching System (ICSS)	ID
3.1.8.5	Tower Communications Switch (TCS)	ID
3.1.8.6	Traffic Management Voice Switch (TMVS)	ID
3.1.8.7	A/G Communications Network	ID
3.1.9.1	Maintenance Staffing Limit	A
3.1.9.2	Fault Detection and Isolation	AD
3.1.9.3	Testing	AD
3.1.9.4	Certification	AD
3.1.10.1	ATC Operational Training	D
3.1.10.2	Traffic Data Collection, Reduction, and Analysis	AD
3.1.10.3	Security	AD
3.1.11	Software Features	A
3.1.11.1	Operating Systems	AD
3.1.12	Alternate Standards	AI
3.2.1	Capacity, Modularity, and Growth	I
3.2.1.1	Capacity	AD
3.2.1.2	Modularity and Growth	DT
3.2.2.1	Grades of service and traffic loads: PBH and PBM	T

Table XVI. Requirements Verification Methods (Continued)

Paragraph	Requirements	Verification Methods
3.2.2.2	Throughput timing requirements	T
3.2.2.2.1.1	A/G PTT transmit response time	T
3.2.2.2.1.2	A/G PTT indicator response time	T
3.2.2.2.1.3	System-generated A/G PTT transmit response time	T
3.2.2.2.l.4	A/G PTT release transmit	T
3.2.2.2.1.5	A/G PTT release indicator	T
3.2.2.2.1.6	Frequency Selection	T
3.2.2.2.1.7	Frequency Deselection	T
3.2.2.2.1.8	Cross Coupling Selection	T
3.2.2.2.1.9	Cross Coupling Deselection	T
3.2.2.2.1.10	Frequency Preemption Activation	T
3.2.2.2.1.11	A/G Lockout Busy Tone	T
3.2.2.2.2	A/G Backup Switch Switchover Response Time	T
3.2.2.2.3	M/S TX/RX Transfer and Confirmation Response Time	T
3.2.2.2.3.1	M/S TX/RX Transfer Response Time	T
3.2.2.2.3.2	M/S TX/RX Transfer Confirmation Response Time	T
3.2.2.2.4	Receiver Muting Response Time	T
3.2.2.2.4.1	Remote Receiver Muting Response Time	T
3.2.2.2.4.2	Remote Receiver Muting Confirmation Response Time	T
3.2.2.2.4.3	Remote Receiver Mute Deselect	T
3.2.2.2.4.4	Remote Receiver Mute Deselect Indicator	T
3.2.2.2.4.5	Local Receive Muting Select	T
3.2.2.2.4.6	Local Receive Mute Select Indicator	T
3.2.2.2.4.7	Local Receive Muting Deselect	T
3.2.2.2.4.8	Local Receive Mute Deselect Indicator	T
3.2.2.2.5	Site Selection Response Time	T
3.2.2.2.5.1	Frequency Site Selection	T
3.2.2.2.5.2	Frequency Site Confirmation	T
3.2.2.2.6	G/G PTT Transmit and Indicator Response Time	T
3.2.2.2.6.1	G/G PTT transmit response time	T
3.2.2.2.6.2	G/G PTT release response time	T
3.2.2.2.7	IC Setup Response Time	T
3.2.2.2.7.1	IC call placement response time	T
3.2.2.2.7.2	IC call acceptance response time	T
3.2.2.2.7.3	IC OVR Call Placement/Acceptance Response Time	T
3.2.2.2.8	IC circuit release time delay	T
3.2.2.2.8.1	IA & IA Override Selection (IC)	T
3.2.2.2.8.2	IC Call Operation Indicator	T
3.2.2.2.8.3	IC Call Ringback Tone	T
3.2.2.2.8.4	IC Busy Tone	T
3.2.2.2.9	IP Call Setup Response Time	T
3.2.2.2.9.1	IP Call Placement Response Time	T

Table XVI. Requirements Verification Methods (Continued)

Paragraph	Requirements	Verification Methods
3.2.2.2.9.1.1	Position-to-trunk IP call placement response time	T
3.2.2.2.9.1.2	Trunk-to-position IP call placement response time	T
3.2.2.2.9.1.3	Position-to-trunk IP OVR Call Placement Response Time	T
3.2.2.2.9.1.4	Trunk-to-position IP OVR Call Acceptance Response Time	T
3.2.2.2.9.2	IP Call Acceptance Response Time	T
3.2.2.2.9.2.1	Position-to-trunk IP call acceptance response time	T
3.2.2.2.9.2.2	Trunk-to-position IP call acceptance response time	T
3.2.2.2.10	IP circuit release response time	T
3.2.2.2.11	Dial tone response time for indirect access	T
3.2.2.2.12	Display devices response time	T
3.2.2.2.13	TED detection response time	T
3.2.2.2.14	Radio Squelch Break Response Time	T
3.2.2.2.15	Radio Squelch Break Indication Response Time	T
3.2.2.2.16	Conference Call Operation/Conference Call Deselect	T
3.2.2.2.17	Conference Call Indicator	T
3.2.2.2.18	Call Hold Operation -- Hold/Resume	T
3.2.2.2.19	Call Forward Operation/Call Forward Select	T
3.2.2.2.20	Call Forward Deselect	T
3.2.2.2.21	Call Forward Select Confirmation	T
3.2.2.2.22	Unacceptable Call Forward Alert	T
3.2.2.2.23	Call Transfer Operation/Call Transfer Selection	T
3.2.2.2.24	Unacceptable Call Transfer Alert	T
3.2.2.2.25	Common Answer Queue/Answer From Common Answer Queue	T
3.2.2.2.26	Confirm Calls in Common Answer Queue	T
3.2.2.2.27.1	Position Voice Monitor Selection	T
3.2.2.2.27.2	Voice Monitor Selection Confirmation	T
3.2.2.2.28	Voice Delay	T
3.2.2.2.28.1	Intrafacility Voice Delay Measurement	T
3.2.2.2.28.1.1	Position-to-Position Voice Delay Measurement	T
3.2.2.2.28.1.2	Position-to-Trunk Voice Delay Measurement	T
3.2.2.2.28.1.3	Position-to-A/G Interface Voice Delay Measurement	T
3.2.2.2.29	PABX Beep Cycle	T
3.2.2.3	System errors	A
3.2.2.3.1	False service disconnects	DT
3.2.2.3.2	False request for service	DT
3.2.2.3.3	Incorrect dial code access	DT
3.2.2.3.4	PTT error rate	DT
3.2.2.4	Reconfiguration timing requirements	T
3.2.2.5	Degraded operation	AD
3.2.2.6	Voice Channel Performance Characteristics	T
3.2.2.6.1	Impedance	T
3.2.2.6.2	Background noise	T

Table XVI. Requirements Verification Methods (Continued)

Paragraph	Requirements	Verification Methods
3.2.2.6.3	Idle channel noise	T
3.2.2.6.4	Impulse noise	T
3.2.2.6.5	Crosstalk between channels	T
3.2.2.6.6	Frequency response	T
3.2.2.6.7	Intermodulation distortion	T
3.2.2.6.8	Harmonic distortion	T
3.2.2.6.9	Longitudinal balance	T
3.2.2.6.10	Gain tracking linearity	T
3.2.2.6.11	Talking State	T
3.2.2.6.12	VF Level Regulation	T
3.2.2.6.12.1	Transmit level regulation	T
3.2.2.6.12.1.1	12-dB sudden increase	T
3.2.2.6.12.1.2	12-dB sudden decrease	T
3.2.2.6.12.2	Receive level regulation	T
3.2.2.6.12.3	Multiple access level regulation	T
3.2.2.7	Sidetone	T
3.2.2.8	Long-term stability	AD
3.2.3	Reliability, Maintainability, Availability (RMA)	A
3.2.3.1	Position-level availability	A
3.2.3.2	System-level availability	A
3.2.3.3	Support functions availability	A
3.3.1.1	General requirements	DI
3.3.1.1.1	Frequency selection	D
3.3.1.1.1.1	Assigned frequency display	D
3.3.1.1.1.2	Displayed frequency values	D
3.3.1.1.1.3	Frequency selection method	D
3.3.1.1.1.4	Routing of incoming voice	D
3.3.1.1.1.5	TX/RX visual indications	D
3.3.1.1.2	M/S transmitter selection	D
3.3.1.1.2.1	M/S transmitter visual indication	D
3.3.1.1.2.2	M/S transmitter selection method	D
3.3.1.1.3	M/S receiver selection	D
3.3.1.1.3.1	M/S receiver visual indication	D
3.3.1.1.3.2	M/S receiver selection method	D
3.3.1.1.4	RESERVED	
3.3.1.1.5	Cross-coupled frequencies	D
3.3.1.1.5.1	Cross-coupling	D
3.3.1.1.5.2	Cross-coupled frequency indication	D
3.3.1.1.5.3	Cross-coupling enabling/disabling methods	D
3.3.1.1.5.4	PTT preemption of cross-coupling	D
3.3.1.1.6	Position control of transmission and reception	D
3.3.1.1.6.1.1	Muting indication	D

Table XVI. Requirements Verification Methods (Continued)

Paragraph	Requirements	Verification Methods
3.3.1.1.6.1.2	Local muting selection method	D
3.3.1.1.6.1.3	Remote muting	D
3.3.1.1.7.3	Multiple sites for a frequency	D
3.3.1.1.7.3.1	RESERVED	
3.3.1.1.8	Automatic transfer of A/G voice routing	D
3.3.1.1.8.1	Automatic transfer of A/G voice-routing indication	D
3.3.1.1.8.2	Automatic transfer of A/G voice-routing selection method	D
3.3.1.1.9	RESERVED	
3.3.1.1.9.1	RESERVED	
3.3.1.1.9.2	RESERVED	
3.3.1.1.10	Selection and assignment of BUEC	D
3.3.1.1.10.1	BUEC indications	D
3.3.1.1.10.2	BUEC selection method	D
3.3.1.1.10.3	BUEC deselection	D
3.3.1.1.11	Selection of emergency frequencies	D
3.3.1.1.11.1	Emergency frequency indications	D
3.3.1.1.11.2	Emergency transmitter activation	D
3.3.1.1.11.3	Emergency transmitter lockout	D
3.3.1.1.12	PTT	DI
3.3.1.1.12.1	PTT lockout	DI
3.3.1.1.12.2	PTT preemption	DI
3.3.1.1.12.3	Radio interface PTT Trunk Lockout	DI
3.3.1.1.12.4	Radio interface PTT lockout	DI
3.3.2.1	General requirements	DI
3.3.2.1.1	Intercom/interphone	DI
3.3.2.1.2	Routing of incoming G/G voice	D
3.3.2.1.2.1	Selection of G/G voice routing	D
3.3.2.1.2.2	Indication of voice routing	D
3.3.2.1.2.3	Incoming G/G call indication	D
3.3.2.1.2.4	Position relief briefing recording	D
3.3.2.1.2.4.1	Pos. relief brief. recording activation	D
3.3.2.1.2.5	Position voice monitoring	D
3.3.2.1.2.5.1	Position voice-monitoring restrictions	D
3.3.2.1.2.5.2	Position voice-monitoring access	D
3.3.2.1.2.6	PTT for G/G communications	D
3.3.2.1.2.6.1	PTT for G/G DA	D
3.3.2.1.2.7	RESERVED	
3.3.2.2	IC/IP	D
3.3.2.2.1	Active IC/IP calls	D
3.3.2.2.2	Call Disconnection	D
3.2.2.2.2.1	Call Release Designator	D
3.3.2.2.2.2	DA call designator release	D

Table XVI. Requirements Verification Methods (Continued)

Paragraph	Requirements	Verification Methods
3.3.2.2.2.3	Release by initiating a call	D
3.3.2.2.2.4	Release by answering a call	D
3.3.2.2.2.5	Release by resuming a call	D
3.3.2.2.2.6	Release indications	D
3.3.2.2.2.7	Last party release	D
3.3.2.2.3	DA	I
3.3.2.2.3.1	Number of DA selectors	I
3.3.2.2.3.2	Latching/nonlatching DA actions	D
3.3.2.2.3.3	DA OVR	D
3.3.2.2.3.3.1	DA OVR call initiation	DI
3.3.2.2.3.3.2	Nonlatching DA OVR call initiation	D
3.3.2.2.3.4	OVR call answering	I
3.3.2.2.3.5	OVR call indications	D
3.3.2.2.4	IA	I
3.3.2.2.4.1	IA call initiation	D
3.3.2.2.4.1.1	IA access keypad enable	D
3.3.2.2.4.2	IA call timeout	D
3.3.2.2.4.3	IA OVR calls	DI
3.3.2.2.4.4	CA queue	DI
3.3.2.2.4.4.1	Caller identification (ID)	DI
3.3.2.2.4.4.2	CA queue depth	DI
3.3.2.2.4.4.3	Call answer queue selection	DI
3.3.2.2.5	Call HOLD	DI
3.3.2.2.5.1	Resuming call on HOLD	DI
3.3.2.2.6	Call forwarding	DI
3.3.2.2.6.1	Enabling call forwarding	D
3.3.2.2.6.2	Disabling call forwarding	DI
3.3.2.2.6.3	Call forwarding indication	DI
3.3.2.2.6.4	Call forwarding closure	DI
3.3.2.2.6.5	Call forwarding chains	D
3.3.2.2.7	RESERVED	
3.3.2.2.7.1	RESERVED	
3.3.2.2.7.2	RESERVED	
3.3.2.2.7.3	RESERVED	
3.3.2.2.8	Conference calls	I
3.3.2.2.8.1	Progressive conferencing	D
3.3.2.2.8.2	Meet-me conferencing	D
3.3.2.2.8.3	RESERVED	
3.3.2.2.8.4	Conference HOLD	D
3.3.2.2.8.5	Release from conference	D
3.3.2.2.8.6	RESERVED	
3.3.2.2.9	Voice calls	D

Table XVI. Requirements Verification Methods (Continued)

Paragraph	Requirements	Verification Methods
3.3.2.2.9.1	Answering voice calls	D
3.3.2.2.9.2	Release from voice calls	D
3.3.2.2.9.3	Voice call indications	D
3.3.2.2.10	Manual ring circuits	D
3.3.2.2.11	IA special functions	D
3.3.2.2.11.1	Interchange of A/G and G/G displays	D
3.3.2.2.12	VSCS numbering plan	I
3.3.3.1	Control of multiple positions	D
3.3.3.2	RESERVED	
3.3.3.2.1	RESERVED	
3.3.3.3	Selective Signaling Trunk Circuits	D
3.3.3.5	Trunk Selection	D
3.3.3.6	A/G and G/G Screen Toggling	D
3.3.3.7	RESERVED	
3.3.3.8	RESERVED	
3.3.4	Ancillary Position Operations	D
3.4.1.1	Communications access	I
3.4.1.2	Human interface	ID
3.4.1.3	Status	ID
3.4.1.4	VSCS database access	D
3.4.1.5	Scope of the display function	I
3.4.2	Human factors	I
3.4.2.2	Conformance to System Level Specification	I
3.4.2.3	Additional Human Factors Requirements	ID
3.4.2.3.1	Interactive display	I
3.4.2.3.1.1	TED physical requirements	ID
3.4.2.3.1.2	TED touch detection	ID
3.4.2.3.1.3	Immunity	ID
3.4.2.3.2	Communications entry/display devices	I
3.4.2.3.2.1	Display capability at an operational position	I
3.4.2.3.2.2	Communications display blink	AD
3.4.2.3.2.3	Communications display size	I
3.4.2.3.3	IA keypad device	ID
3.4.2.3.3.1	IA keypad pushbutton	I
3.4.2.3.3.2	Alphanumeric display	ID
3.4.2.3.3.3	Installation	I
3.4.2.3.3.4	IA Keypad Construction	ID
3.4.2.3.4	Data entry devices	ID
3.4.2.3.4.1	Operator review	ID
3.4.2.3.4.2	Keyboard configurations	ID
3.4.2.3.5	Display refresh	AID
3.4.2.3.6	Display brightness	ID

Table XVI. Requirements Verification Methods (Continued)

Paragraph	Requirements	Verification Methods
3.4.2.3.7	Feedback to operators	ID
3.4.2.3.7.1	Function timeouts	AD
3.4.2.3.8.1	Headsets/handsets and PTT switches	I
3.4.2.3.8.2	Loudspeakers	I
3.4.2.3.8.2.1	LS volume control	I
3.4.2.3.8.3	Foot Switch	I
3.4.2.3.8.4	Speech intelligibility	DT
3.4.3	Special Entry/display Controls	I
3.4.3.1	RESERVED	
3.4.3.2	Display selection	ID
3.4.4	Ancillary positions	ID
3.4.4.l	Ancillary position requirements	I
3.4.4.2	Special classmark requirements	I
3.4.4.3	RESERVED	
3.4.5	Supervisory positions	ID
3.4.5.1	Supervisory position equipment	I
3.4.5.2	Supervisory functions	ID
3.4.5.2.1	Supervisory monitoring of ATC positions	ID
3.4.5.2.2	Supervisory position voice recording and playback	I
3.4.5.2.2.1	Supervisory position voice recording and playback equipment	ID
3.4.5.2.3	Supervisory monitoring of operational position displays	ID
3.4.5.2.4	FTS monitoring of A/G	ID
3.4.5.3	Supervisory control of position reconfiguration	ID
3.4.6	VSCS local maintenance position	I
3.4.6.1	Local maintenance position equipment	ID
3.4.6.1.1	Local maintenance position features	ID
3.4.6.1.2	Test panel	ID
3.4.6.2	Local maintenance theory of operation	D
3.4.7	Data entry position	ID
3.4.7.1	Data entry position equipment	ID
3.4.7.2	Data entry position software	ID
3.4.8	Reconfiguration command entry and display	ID
3.4.8.1	Configuration map and access	ID
3.4.8.1.1	Hardcopy listings of configuration maps	ID
3.4.8.1.2	Reconfiguration status reporting	ID
3.4.8.1.3	Limitations of reconfiguration	ID
3.4.9.1	Scope of display function hardware	I
3.4.9.2	VSCS Console Equipment	I
3.4.9.2.1	Position headset/handset/PTT jacks	ID
3.4.9.2.2	RESERVED	
3.4.9.3.1	Communications control display devices	ID
3.4.9.3.2	Touch entry devices	ID

Table XVI. Requirements Verification Methods (Continued)

Paragraph	Requirements	Verification Methods
3.4.9.3.3	IA keypad entry and display devices	ID
3.4.9.3.4	Position loudspeaker(s)	ID
3.4.9.3.4.1	LS volume controls	ID
3.4.9.3.4.2	RESERVED	
3.4.9.3.4.3	LS performance	IT
3.4.9.3.5	Chimes	ID
3.4.9.3.5.1	Chime volume	ID
3.4.10	Location of console equipment	I
3.4.11	C/C equipment power	AT
3.5	Switching and control functions	ID
3.5.1.1	Modularity	ID
3.5.1.2	Program control	I
3.5.1.3	Technology utilization	IA
3.5.1.4	RESERVED	
3.5.1.5	RESERVED	
3.5.2.1.1	A/G Special Features	ID
3.5.2.1.1.1	Assigned frequencies	AD
3.5.2.1.1.2	Fan-in feature	ADT
3.5.2.1.1.2.1	Emergency frequency fan-in	AD
3.5.2.1.1.3	Fan-out feature	ADT
3.5.2.1.1.3.1	Emergency frequency fan-out	AD
3.5.2.1.1.4	Multiple locations of a frequency	D
3.5.2.1.1.5	Cross-coupling	D
3.5.2.1.1.6	RESERVED	
3.5.2.1.1.7	PTT lockout	D
3.5.2.1.1.7.1	Radio interface PTT Trunk Lockout Signal	D
3.5.2.1.1.7.2	PTT lockout for multiple assignment of a frequency	D
3.5.2.1.1.8.1	Position jack preemption	D
3.5.2.1.1.8.2	PTT preemption	D
3.5.2.1.1.8.3	RESERVED	
3.5.2.1.1.8.4	Cross-coupling preemption	D
3.5.2.1.2.1	Configuration for A/G	DI
3.5.2.1.2.1.1	Configuration for Existing Radio Interface	DI
3.5.2.1.2.2	Frequency selection	DI
3.5.2.1.2.2.1	Frequency deselection	DI
3.5.2.1.2.3	PTT and voice transmission	D
3.5.2.1.2.3.1	PTT for selective frequency operations	D
3.5.2.1.2.3.2	PTT for split operations	D
3.5.2.1.2.3.3	Multiple transmissions at a position	D
3.5.2.1.2.4	A/G voice reception	D
3.5.2.1.2.4.1	Multiple receptions at a position	D
3.5.2.1.2.5	Activation of radio interface control changes	D

Table XVI. Requirements Verification Methods (Continued)

Paragraph	Requirements	Verification Methods
3.5.2.1.2.6	Enabling/disabling transmission/reception	D
3.5.2.1.3	A/G using BUEC	D
3.5.2.1.3.1	BUEC interface configuration	DI
3.5.2.1.3.2.1	Request selection	D
3.5.2.1.3.2.2	Malfunction indication	D
3.5.2.1.3.2.3	Priority indication	D
3.5.2.1.3.2.4	Request deselection	D
3.5.2.1.3.2.5	Voice communications interface	T
3.5.2.1.3.2.6	Command and status signal interface	T
3.5.2.1.3.3	PTT and voice transmission	D
3.5.2.1.3.3.1	PTT signal interface	T
3.5.2.1.3.4	BUEC voice reception	D
3.5.2.1.4	A/G backup switch operation	D
3.5.2.1.4.1	Hot backup	D
3.5.2.1.4.2	Total switchover	D
3.5.2.1.4.3	A/G backup switch switchover threshold	D
3.5.2.1.4.4	A/G Backup Switch Manual Recovery	D
3.5.2.2	G/G Communications	D
3.5.2.2.1	Call processing	D
3.5.2.2.2	VSCS switch features	D
3.5.2.2.2.1	Calling source identification	D
3.5.2.2.2.2	DA calls	D
3.5.2.2.2.2.1	Calling party DA	D
3.5.2.2.2.2.2	Called party DA	D
3.5.2.2.2.2.3	DA release	D
3.5.2.2.2.3	IA calls	D
3.5.2.2.2.3.1	Calling party IA	D
3.5.2.2.2.3.2	Called party CA	D
3.5.2.2.2.3.3	Called party CA busy	D
3.5.2.2.2.3.4	CA answer	D
3.5.2.2.2.3.5	Calling party queue release	D
3.5.2.2.2.3.6	IA release	D
3.5.2.2.2.4	OVR	D
3.5.2.2.2.4.1	OVR Signaling	AD
3.5.2.2.2.4.2	Calling party DA OVR	D
3.5.2.2.2.4.3	Calling party IA OVR	D
3.5.2.2.2.4.4	Called party	D
3.5.2.2.2.4.5	Initiating calls during an OVR	D
3.5.2.2.2.4.6	Simultaneous OVR	D
3.5.2.2.2.4.7	Simultaneous OVR conference limitation	AD
3.5.2.2.2.4.8	Extended OVR capability	AD
3.5.2.2.2.4.9	OVR release	D

Table XVI. Requirements Verification Methods (Continued)

Paragraph	Requirements	Verification Methods
3.5.2.2.2.5	Conferencing	AD
3.5.2.2.2.5.1	Meet-me conference	D
3.5.2.2.2.5.2	Progressive conference	D
3.5.2.2.2.5.3	RESERVED	
3.5.2.2.2.6	Voice call	AD
3.5.2.2.2.6.1	Voice call, calling position	D
3.5.2.2.2.6.2	Voice call, called position	D
3.5.2.2.2.6.3	Voice call, IA	D
3.5.2.2.2.6.4	Voice call release	D
3.5.2.2.2.7	Call forwarding	D
3.5.2.2.2.8	RESERVED	
3.5.2.2.2.9	Call HOLD	D
3.5.2.2.2.10	Voice Routing	AD
3.5.2.2.2.10.1	Monitoring	D
3.5.2.2.2.10.2	Supervisory recording	D
3.5.2.2.2.10.3	Voice recording	D
3.5.2.2.2.10.4	HS/LS voice routing	D
3.5.2.2.3.1	Trunk signaling VSCS-VSCS	A
3.5.2.2.3.2	Trunk signaling interfaces with existing systems	A
3.5.2.2.3.3	Voice call signaling	AT
3.5.2.2.3.4	Selective signaling	D
3.5.2.2.3.5	Immediate dialing (type 7)	D
3.5.2.2.3.6	Trunk signaling, VSCS-PABX	D
3.5.3.1.1	Centralized operator communication	D
3.5.3.1.1.1	Supervisory positions	D
3.5.3.1.1.2	Maintenance position	D
3.5.3.1.2	Centralized database	AD
3.5.3.2	Status monitoring and control	D
3.5.3.2.1	Operations status monitoring	D
3.5.3.2.2	Performance status monitoring	AD
3.5.3.2.2.1	Performance reporting	D
3.5.3.2.2.1.1	Reports to maintenance position	D
3.5.3.2.2.1.2	RESERVED	
3.5.3.2.2.1.3	RESERVED	
3.5.3.2.2.1.4	RESERVED	
3.5.3.2.2.1.5	RESERVED	
3.5.3.2.2.2	Failure logging	D
3.5.3.2.3	Control	DT
3.5.3.2.3.1	Failure recovery	DT
3.5.3.2.3.1.1	Functional recovery	DT
3.5.3.2.3.1.2	Voice path recovery	DT
3.5.3.2.3.2	Diagnostic control	D

Table XVI. Requirements Verification Methods (Continued)

Paragraph	Requirements	Verification Methods
3.5.3.2.3.3	Reporting selection control	D
3.5.3.3	On-line/off-line diagnostics	AT
3.5.3.3.1	On-line diagnostics	AT
3.5.3.3.2	Off-line diagnostics	AT
3.5.3.3.3	Diagnostic interfaces	AT
3.5.3.3.3.1	Maintenance and supervisory position interfaces	D
3.5.3.3.3.2	RESERVED	
3.5.3.3.3.3	Remote terminal interface	D
3.5.4.1	Reconfiguration	DT
3.5.4.1.1	Characteristics	D
3.5.4.1.1.1	Configuration	AD
3.5.4.1.1.1.1	Physical maps	AI
3.5.4.1.1.1.1.1	Service classmarks	T
3.5.4.1.1.1.1.2	Physical characteristics	AT
3.5.4.1.1.1.2	Position maps	AT
3.5.4.1.1.1.2.1	Operational classmarks	I
3.5.4.1.1.1.2.2	Communications assignments	AI
3.5.4.1.1.1.2.3	RESERVED	
3.5.4.1.1.1.3	Switch maps	AI
3.5.4.1.1.1.4	RESERVED	
3.5.4.1.1.1.4.1	RESERVED	
3.5.4.1.1.1.4.2	RESERVED	
3.5.4.1.1.2	Configuration Database	AD
3.5.4.1.1.3	Reconfiguration levels	A
3.5.4.1.1.3.1	RESERVED	
3.5.4.1.1.3.2	RESERVED	
3.5.4.1.1.3.3	RESERVED	
3.5.4.1.1.3.4	RESERVED	
3.5.4.1.1.4	Timing performance	D
3.5.4.1.2	Reconfiguration initiation	AD
3.5.4.1.2.1	Reconfiguration initiation by AAS	AD
3.5.4.1.2.2	RESERVED	
3.5.4.1.2.3	Reconfiguration initiation by maintenance position	D
3.5.4.1.2.4	Priority of reconfiguration commands	D
3.5.4.1.2.5	Initiation commands	D
3.5.4.1.3	Operational sequence	D
3.5.4.1.3.1	Simultaneous reconfigurations	D
3.5.4.1.3.2	A/G backup switch reconfiguration	AD
3.5.4.1.4	Monitor and control	AD
3.5.4.1.5	Configuration database management	AD
3.5.4.1.5.1	Database contents	A
3.5.4.1.5.2	Database size	A

Table XVI. Requirements Verification Methods (Continued)

Paragraph	Requirements	Verification Methods
3.5.4.1.5.3	Map creation	AT
3.5.4.1.5.4	Map modification	AT
3.5.4.1.5.5	Map validation	AT
3.5.4.1.5.6	Database utilities	A
3.5.4.1.5.7	Database access	AD
3.5.4.1.6	Recovery processes	AD
3.5.4.1.6.1	Automatic recovery	AD
3.5.4.1.6.2	Manual recovery	AD
3.5.4.2	Traffic data collection, reduction, and analysis	AD
3.5.4.2.1	Traffic data	AD
3.5.4.2.2	Traffic data collection	AD
3.5.4.2.2.1	Voice communications traffic data collection	D
3.5.4.2.2.2	Other communications traffic data collection	D
3.5.4.2.3	RESERVED	
3.5.4.2.3.1	RESERVED	
3.5.4.2.3.2	RESERVED	
3.5.4.2.3.3	RESERVED	
3.5.4.2.4	RESERVED	
3.5.4.2.4.1	RESERVED	
3.5.4.2.4.1.1	RESERVED	
3.5.4.2.4.2	RESERVED	
3.5.4.2.4.3	RESERVED	
3.5.4.2.5	Data transfer	AI
3.5.4.2.5.1	Data to tape	AD
3.5.4.3	System startup	AD
3.5.4.3.1	Warm start	D
3.5.4.4	Timing and Synchronization	AD
3.5.4.4.1	Time of day	T
3.5.4.4.1.1	Reset of time of day	D
3.5.4.4.2	System timing and synchronization	D
3.5.4.4.2.1	Clock Stability	T
3.5.4.5	Support processing	AD
3.5.4.5.1	Interface to on-line system	ADT
3.5.4.5.2	Functional description	AD
3.5.4.5.2.1	Reconfiguration database management	AD
3.5.4.5.2.2	Traffic data reduction and analysis	ADT
3.5.4.5.2.3	RTQC data collection and reporting	ADT
3.5.4.5.2.4	VSCS operational program startup	AD
3.5.4.5.2.5	Changes to operating system and software	D
3.6.2	VSCS-ACCC (Common Console)	AT
3.6.3	RESERVED	
3.6.4	RESERVED	

Table XVI. Requirements Verification Methods (Continued)

Paragraph	Requirements	Verification Methods
3.6.5	Existing Radio Interface	AT
3.6.6	VSCS-BUEC	AT
3.6.7	VSCS-PABX	AT
3.6.8	VSCS-Trunks	AT
3.6.9	VSCS-REC	AD
3.6.10	RESERVED	
3.6.11	RESERVED	
3.6.12	RESERVED	
3.6.13	RESERVED	
3.6.14	VSCS-Power	TI
3.6.15	VSCS-Existing Radio Interfaces	TI
3.6.16	RESERVED	
3.6.17	VSCS-Transmission Equipment (Analog)	AT
3.6.18	VSCS to TCS	AT
3.7.2.1	Single-point failure	AT
3.7.2.2	Secondary failure	AT
3.7.2.3	Redundancy	AT
3.7.2.4	Reliability program	AT
3.7.3.1	RESERVED	
3.7.3.2	Preventive maintenance (PM)	AT
3.7.3.3	Mean time to repair (MTTR)	AT
3.7.3.4	Maintenance requirements	AT
3.7.3.5	Service and access	AT
3.7.3.6	Test points	AT
3.7.3.7	Modules	AT
3.7.3.7.1	Functional partitioning	AT
3.7.3.8	Diagnostic requirements	AT
3.7.3.9	Maintainability program	AT
3.8.1	Plan	AT
3.8.1.1	Automatic verification	AT
3.8.2	BIT/BITE	AT
3.8.2.1	BIT/BITE functions	AT
3.8.3	Applicability	AT
3.8.4	Methodology	D
3.9	System design and construction	I
3.9.1	Interchangeability	I
3.9.2	Dissimilar metals	I
3.9.3	Service life	AD
3.9.4.1	Equipment layout	I
3.9.4.1.1	RESERVED	
3.9.4.1.2	Workshop and storage area floor space	I
3.9.4.2	Module removal and insertion damage	I

Table XVI. Requirements Verification Methods (Continued)

Paragraph	Requirements	Verification Methods
3.9.4.3	Printed circuit assemblies	I
3.9.4.4	Cabinet and frame construction	I
3.9.4.4.1	Cabinet and frame prewiring	I
3.9.4.4.1.1	Existing on-site console and frame expandability	I
3.9.4.4.2	Cabinet and frame convenience outlets	I
3.9.4.4.3	Cable entrance and exit	I
3.9.4.5	RESERVED	
3.9.4.5.1	RESERVED	
3.9.4.5.2	Test and measurement access and isolation	I
3.9.4.6	Protector frames	I
3.9.4.7	Lightning protection	I
3.9.4.8	Acoustic noise levels	T
3.9.4.9	Intraconnection and interconnection cables	I
3.9.4.9.1	Cable connectors	I
3.9.4.9.2	Cable end terminations	I
3.9.4.9.3	House cables	I
3.9.4.9.4	Position cables	I
3.9.4.9.5	Power cables	I
3.9.4.9.6	Grounding cables	I
3.9.4.10	Cabinet ventilation and cooling	T
3.9.4.10.1	Air filters	I
3.9.4.10.2	Overheat warning	T
3.9.4.11	Color and texture of finishes	I
3.9.4.12	Identification, marking and nameplates	I
3.9.5.1	Temperature, humidity, and altitude conditions	T
3.9.5.2.1	Random vibration	T
3.9.5.2.2	Shock requirements	T
3.9.5.3	EMC/EMI surveys	T
3.9.5.4	Electromagnetic interference (EMI) requirements	AT
3.9.5.4.1	CE03, conducted emissions, narrowband and broadband	AT
3.9.5.4.2	CS01, conducted susceptibility, power leads	AT
3.9.5.4.3	CS02, conducted susceptibility, power leads	AT
3.9.5.4.4	CS06, conducted susceptibility, spikes, power leads	AT
3.9.5.4.5	RE02, radiated emissions, narrowband and broadband	AT
3.9.5.4.6	RS03, radiated susceptibility, electric field	AT
3.9.6	FCC registration	I
3.9.7	Electrical power	D
3.9.7.1	VSCS switching equipment	D
3.9.7.2	VSCS Common Console Equipment (VCE)	D
3.9.7.3	VSCS Site Power	
3.9.7.4	RESERVED	
3.9.8	AC power distribution	D

Table XVI. Requirements Verification Methods (Continued)

Paragraph	Requirements	Verification Methods
3.9.9	Electrical service conditions, transient state	T
3.9.10	Startup surges	T
3.9.11	Power supplies	T
3.9.12.1	AC-to-DC converters; voltage and current requirements	D
3.9.13	Powerline EMI reduction requirements	DI
3.9.14.1	General	I
3.9.14.2	AC ground	I
3.9.14.3	Chassis ground	I
3.9.14.4	Signal ground	I
3.9.14.5	Communications trunk circuit ground	I
3.9.15	Position equipment divided power connections	I
3.9.16	AC line receptacle and power cord	I
3.10.1	Software categories	I
3.10.1.1.1.1	Real-time executive	AD
3.10.1.1.1.2	File management facility	AD
3.10.1.1.1.3	Command file procedures	AD
3.10.1.1.2.1	Data management libraries	AD
3.10.1.1.2.2	Mathematical libraries	AD
3.10.1.1.2.3	Menu generation capabilities	AD
3.10.1.1.2.4	Compilers/assemblers	AD
3.10.1.2	Applications software	ADT
3.10.1.2.1	Application functions	DT
3.10.1.3	Support software	ADT
3.10.2	Software Planning, Design, and Implementation	I
3.10.2.1	Software Design	A
3.10.2.1.1	Unit Attributes	A
3.10.2.1.2	Design Representation	A
3.10.2.1.3	Special Tools and Techniques	AD
3.10.2.2	Software implementation	A
3.10.2.2.1	Unit Attributes	A
3.10.2.2.2	Special Tools and Techniques	AD
3.10.2.2.3	Detailed design	AI
3.10.2.2.4	Coding and unit testing	ADI
3.10.2.2.5	CSC integration and testing	AT
3.10.2.2.6	CSCI-level testing	ATI
3.10.2.2.7	Development tools	ADI
3.10.2.3	Design Language, Tools, Development Aids and Higher order	I
3.10.2.3.1	Architecture	A
3.10.2.3.2	Unit attributes	AT
3.10.2.3.3	Design representation	AD
3.10.2.3.4	Special tools and techniques	AI
3.10.2.4	Software implementation	AI

Table XVI. Requirements Verification Methods (Continued)

Paragraph	Requirements	Verification Methods
3.10.2.4.1	Unit attributes	AT
3.10.2.4.2	Special tools and techniques	AI
3.10.2.5	Use of commercial and reusable software	DI
3.10.2.6	Software configuration management	DI
3.10.2.7	Design language, tools, development aids, etc.	DI
3.10.2.7.1	Program code	I
3.10.3	Software reliability	AD
3.11.1	Security	I
3.11.1.1	Remote access control	I
3.11.2	Safety	ID
3.12.1	Operational Redundancy	AD
3.12.2	Transition Equipment	DT
3.12.3	Communication System Availability	A
3.13	RESERVED	
4.2	Quality Controls	TI
4.2.1	Hardware quality control program	I
4.2.2	Software quality control	I
4.2.2.1	Software stability tests	T
4.2.2.2	Software stress tests	T
4.3	RESERVED	
4.4	RESERVED	
4.5	Developmental Testing and Analysis	AT
4.6	Reliability and Maintainability Demonstration Tests	AT
4.6.1	System reliability demonstration test (includes subparagraphs)	AT
4.6.2	System maintainability demonstration test (includes subparagraphs)	AT
4.8	Retest	AT
4.9	Factory Test	AT
4.9.1	Design Qualification Tests	AT
4.9.2	Production Test	AT
4.9.3	Type Tests	AT
4.10	Site Acceptance Tests	AT

Definition of Symbols

A - Analysis
D - Demonstration
T - Test
I - Inspection

5.0 PREPARATION FOR DELIVERY

5.1 GENERAL

The contractor shall guarantee the equipment integrity from factory to final installation site.

5.1.1 Level of Preservation Protection

The level of preservation shall afford adequate protection against corrosion, deterioration, and physical damage during shipment from the supply source to the receiving activity at the FAA where the item may be subject to immediate use or storage.

5.1.2 Level of Packing Protection

The level of packing shall afford protection against damage during direct domestic shipment from the supply source to the first receiving activity for immediate use. This level, in general, will conform to applicable carrier rules and regulations.

5.2 PACKING

Equipment packed for shipment to another location or to a Depot shall be packed such that it will not be damaged in transit. The equipment shall be checked and suitably packed for heavy components, such as transformers, which may need additional bracing or support to avoid damage in the event the container is dropped during handling.

5.2.1 Blocking and Bracing

Unless otherwise secured, items that do not completely fill the container shall be blocked and braced to prevent movement inside the container. Items having projecting parts that are subject to damage or would tend to damage the barrier media shall be rigidly supported. Blocking or bracing shall be applied against areas of the items that are of sufficient strength and rigidity to resist damage. Distribution of supports to several points or to a large area of the item shall be provided. Ends of wood blocks or braces shall not be fastened to a wood container by end-grain nailing, toe nailing, or similar methods. They shall be fastened to sturdy parts of areas of the container, or held in grooves formed by parallel cleats or securely socketed.

5.2.2 Cushioning

Cushioning materials (or devices) shall be used to protect the contents and the preservation and packaging components from physical damage. The cushioning medium shall be placed as close to the items as practicable to prevent flexible barrier rupture or to ensure against free movement in rigid containers.

5.2.3 Bolting

Items such as subassemblies, having bolt holes in part of the item that is sturdy enough to resist breakage when handled roughly, shall, if practical, be bolted to one face of the container. In instances involving nonprecision bolt holes, the diameter of the bolt shall be the nearest standard size consistent with the diameter of the hole. In instances involving precision bolt holes, precaution shall be taken to ensure precision fitting bolts of proper characteristics to prevent marring or elongation; lag screws or lag bolts shall not be used. Holes bored through containers or mounting bases shall be the same size as the diameter of the bolt used. When container bases are provided with skids, the bolts shall extend through the skids whenever practical, and the bolts countersunk in the outer surface of the skid.

5.2.3.1 Securing Bolts - Standard cut washers shall be used under nuts to contact with wood. To ensure that the nuts will not come loose in transit, they must be positively secured by applying asphaltum, paint, or lacquer on the threads; by use of lock nuts; or by use of cotter pins with nuts. Bolts and nuts without corrosion-resistant finish shall, prior to use, be completely covered with a corrosion-preventive compound.

5.2.4 Packing Small Components and Material

Small individual items or components shall be packed and marked both internally and on the exterior surface of the containers. Packing of this material shall be in accordance with MIL-E-17555, Level C.

5.2.5 Packing for Spares and Storage

All spare parts shall be marked, packaged, and packed for delivery and/or storage in accordance with the requirements of MIL-E-17555 using Level A preservation and packaging, and Level C packing.

5.2.5.1 Time and Temperature Control - The contractor shall mark material and articles with definite characteristics of quality degradation during shelf life. Material that is temperature sensitive shall be identified for storage in the manner specified by the manufacturer. Delivered material shall not have exceeded one-fourth of its shelf life.

5.2.6 Barrier Material

A sealed, waterproof/vaporproof bag or equivalent shall be provided as a protective wrapping over all VSCS components and equipment.

5.2.7 Items Included in Packing

The following items shall be included as defined in the contract:

a. Instruction books,

b. Spare parts,

c. Cables and accessory items furnished with the equipment,

d. Modification records,

e. Any parts or assemblies removed for reasons other than an agency-wide modification. This would include any item removed to satisfy conditions unique to one facility, but which may be needed if the equipment should be installed at another facility.

f. Any modification kits on hand, but not installed in the equipment to be transferred,

g. Other necessary records (e.g., repair log book, etc.).

5.2.8 Marking

Each shipping container shall be marked to allow identification of contents without unpacking. Marking shall be applied on the bag and on the container. Marking requirements, including materials, methods, and sizes of markings, shall be in accordance with MIL-STD-129.

5.2.9 Packing List

Each individual shipping container, or one container of each shipment, shall contain a packing list showing in detail a complete description and quantities of each item in the shipment. When the packing list is enclosed in one container of the group, that container shall be clearly marked "PACKING LIST INSIDE." It is also permissible to place the packing list in a heavy envelope marked "PACKING LIST," and securely fasten it to one of the containers. The packing list shall contain the following minimum information:

a. Unit names(s),
b. Part number(s),
c. Serial number(s),
d. Manufacturer,
e. Shipping number,
f. Date packed,
g. Originating location,
h. Destination.

5.3 SHIPMENT

Shipment of all material and equipment required for VSCS installation at any site shall be the responsibility of the contractor including off-loading and emplacement of equipment. Shipment of VSCS equipment from the contractor's plant to a specific site within the continental limits of the United States shall be by a padded electronic-equipment-type moving van.

6.0 NOTES

6.1 NOTE ON INFORMATION ITEMS

The contents of this section are for information for the initiator of the procurement request only and are not a part of the requirements of this specification. They are not contractor requirements nor binding on either the FAA or the contractor. In order for these terms to become a part of the resulting contract, they must be specifically incorporated in the schedule of the contract. Any reliance placed by the contractor on the information in these paragraphs is at the contractor's own risk.

6.2 THROUGHPUT PERFORMANCE DESIGN QUALIFICATION

This section serves as an elaboration of the requirement specified in paragraph 4.9.1.2 for the type-I risk of 5% to be allowed for the measurements of throughput performance timing. This type-I risk, is the probability of erroneously rejecting a tested item which meets the design specification. It always exists in the testing of items with statistical behavior. The risk can be constrained but not eliminated by determining the number of failed samples allowed in a test so that the probability of failing a zero margin system is reduced to an acceptable level. This is to avoid the virtually certain declaration of failure of an ideal system. This is the origin of the "type-I risk" allowance.

a. With an ideal system, there is a significant probability of failing a test if the testing criterion is the same as the design criterion (specification ratios). In the case of a 99.9% requirement with a 1000 sample test, the probability of an ideal system failing this one test is 26.424% (the probability of two or more failures) calculated from the binomial distribution with N = 1000, p = 0.001 and (1 - p) = 0.999. In a test program where a system is subjected to multiple tests, the probability of failing at least one of them increases exponentially with the number of tests.

b. For type-I risk to be 5% or less, the formulas which apply are as follows:

$$P(n) = \sum_{i=0}^{n} \binom{N}{i} p^{i} (1-p)^{N-i}$$

$$(1 - P(n))^{k} \geq \%R$$

Definitions:

p	is the probability of failing a single sample in a test
n	is the number of failed samples to be allowed in a test
N	is the number of samples in a test
K	is the number of tests
%R	is (1 - the type-I risk) or .95

A sample is an individual measurement
A test is a set of N samples
A test set is the battery of tests (in example below, the number of tests = 207)

c. As an example;

With 207 tests, the probability of failing at least one test is [1 - (2.6×10^{-28})] which is overwhelming near certainty. The probability of failing each test must be reduced to 0.0002477628 since $(1 - 0.0002477628)^{207} = (1 - 0.05)$.

The number of failures to be allowed is determined by generating the binomial distribution for the number of samples with the specified performance ratio and recording the smallest number of failed samples with a probability lower than 0.0002477628. The following table lists the illustration example for the number of failures to be allowed for p = 0.05, (1 - p) = 0.95 and for p = 0.001, (1 - p) = 0.999 and the test sizes for test data sets available, and a 5% risk failure allowance for testing a parameter designed to a 0.05 or 0.001 failure probability when the test is one of 207 tests.

Number of Samples Based on 207 Tests	Number of Failures to be Accepted 95%	99.9%
1000	76	6
1888	129	8
2000	136	8
2028	137	9
3513	222	12
3760	236	12
3888	243	12
4077	254	13
5404	328	15
7520	443	19
7776	457	19
10000	578	23
10088	582	23
14463	814	29
21136	1168	39
23244	1279	42
24943	1368	44
40000	2149	64
40778	2195	65
46000	2464	71
89928	4726	125
92888	4878	128
100000	5243	137

10.0 ACRONYMS, ABBREVIATIONS, DEFINITIONS, TERMS, AND FORMULAS

10.1 ACRONYMS AND ABBREVIATIONS

AAS	Advanced Automation System
AC	Alternating Current
ACCC	Area Control Computer Complex
ACF	Area Control Facility
AGC	Automatic Gain Control
A/G	Air-to-Ground
AF	Airway Facilities
AFI	Automated Fault Isolation
ANSI	American National Standards Institute
ARTCC	Air Route Traffic Control Center
AT	Air Traffic
ATC	Air Traffic Control
ATCS	Air Traffic Control Specialist
ATCT	Air Traffic Control Tower
ATIS	Automated Terminal Information Service
AWACS	Airborne Warning and Control System
BIT	Built-In Test
BITE	Built-In Test Equipment
BITS	Built-In Test Sequences
BSTR	Bell System Technical Reference
BUEC	Backup Emergency Communications
CA	Common Answer
C/C	Common Console
CFCF	Central Flow Control Facility
CHI	Computer-Human Interface
CRT	Cathode Ray Tube
CSC	Computer Software Component
CSCI	Computer Software Configuration Item
CTSU	Contractor Traffic Simulation Unit
DA	Direct Access
DAPS	Display and Planning System
DC	Direct Current
DEO	Data Entry Operator
DOD-SSP	Department of Defense - Single Stock Point
DJM	Dual Jack Module
DSR	Display System Replacement
DT&E	Developmental Testing and Evaluation
DYSIM	Dynamic Simulation
ED	Entry Device
EIA	Electronic Industries Association
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ESD	Electrostatic Discharge

FAA	Federal Aviation Administration
FAAAC	FAA Aeronautical Center
FAATC	FAA Technical Center
FCC	Federal Communications Commission
FPA	Fix Posting Area
FTS	Federal Telecommunications System
GFE	Government-Furnished Equipment
G/G	Ground-to-Ground
GMT	Greenwich Mean Time
HS	Headset
HS/LS	Headset/Loudspeaker
IA	Indirect Access
IC	Intercom
ICD	Interface Control Document
ICSS	Integrated Communications Switching System
ID	Identification
IDF	Intermediate Distribution Frame
IEC	International Electrotechnical Committee
IOC	Initial Operating Capability
I/O	Input/Output
IP	Interphone
IRD	Interface Requirements Document
ISSS	Initial Sector Suite System
LCD	Liquid Crystal Display
LRU	Line Replaceable Unit
LS	Loudspeaker
LTP	Logical-to-Physical
MBRT	Mean Bench Repair Time
MDS	Master Demarcation System
MIL-STD	Military Standard
MPS	Maintenance Processor System
M/S	Main/Standby
MTBCF	Mean Time Between Critical Failures
MTBF	Mean Time Between Failures
MTBPMA	Mean Time Between Preventive Maintenance Actions
MTBUMA	Mean Time Between Unscheduled Maintenance Actions
MTTR	Mean Time to Repair
MTTR(S)	Mean Time to Repair for the System
NAS	National Airspace System
NPFC	Naval Publications and Forms Center
OT&E	Operational Testing & Evaluation
OVR	Override
PABX	Private Automatic Branch Exchange
PBH	Peak Busy Hour
PBM	Peak Busy Minute
PC	Personal Computer
PCS	Power Conditioning System

PDL	Program Design Language
PM	Preventive Maintenance
PSTN	Public Switched Telephone Network
PTT	Push-to-Talk
QA	Quality Assurance
RCE	Radio Control Equipment
RCF	Radio Control Facility
RDCC	Research & Development Computer Complex
REC	Recording
RI	Radio Interface
RMA	Reliability, Maintainability, Availability
RTQC	Real-Time Quality Control
RX	Receive
SAD	Site Adaptation Data
SPL	Sound Pressure Level
SPS	Software Production Specification
SPS	System Performance Specialist (Also)
SPST	Single Pole - Single Throw
SSCC	System Support Computer Complex
SST	System Shakedown Testing
S/S	Sector Suite
STD	Standard
TCCC	Tower Control Computer Complex
TCS	Tower Communications Switch
TED	Touch Entry Device
TEPD	Talker Echo Path Delay
TEPLL	Talker Echo Path Loudness Loss
TMDE	Test, Measurement & Diagnostic Equipment
TMVS	Traffic Management Voice Switch
TSU	Traffic Simulation Unit
TX	Transmit
UHF	Ultra-High Frequency
VCE	VSCS Console Equipment
VCET	VCE Trainer
VDF	VSCS Distribution Frame
VDM	VSCS Display Module
VF	Voice Frequency
VHF	Voice High Frequency
VOX	Voice-Operated Switch
VSE	VSCS Switching Equipment
VSCS	Voice Switching and Control System
WECO, WE	Western Electric Company
WECO 300/301	Four-wire telephone key systems employed at large ATC facilities
XTS	External Time Source
0TLP	Zero Transmission Level Point

10.2 DEFINITIONS AND TERMS

Action, Continuous Touch - A manual operation at the VSCS human/system interface which initializes and uses certain communication circuits and VSCS controls that are activated for the duration of the continuous touch action, and deactivated with the cessation of the continuous touch action.

Action, Single Touch - An operation that occurs at the VSCS human/system interface which affects communication circuits and VSCS controls in one of two ways: (1) momentary-to-make (latch or enable), and (2) momentary-to-break (unlatch or disable).

Active Call or Position Active Call - A call (placed or received) under the control of position operator, and to which they are conversant.

Active Position - An operable controller position functioning with respect to a configuration map.

Active Sector - A sector in which air traffic control is provided in one or more assigned fix posting areas.

Address:

a. A character or group of characters that identifies a register, a specific part of storage, or some other data source or destination,

b. To refer to a device or an item of data by its address.

Advanced Automation System (AAS) - A system of four computer complexes that support air traffic control. The four computer complexes are:

a. Area Control Computer Complex (ACCC) at ARTCC and ACF,
b. Tower Control Computer Complex (TCCC) at Air Traffic Control Tower (ATCT),
c. System Support Computer Complex (SSCC) at FAATC,
d. Research and Development Computer Complex (RDCC) at FAATC.

Air Traffic Control Position - A common console configured for en route or terminal air traffic control activities.

Air Traffic Controller - A person authorized to provide air traffic service including en route and terminal approach control.

Ancillary Position - A common console configured for non-air traffic control activities including:

a. Area Manager,
b. NAS Manager,
c. Area Supervisor,
d. Traffic Management,
e. En Route Metering,
f. Military Operations Specialist,
g. Weather Coordinating,
h. Automation Specialist,
i. Flight Data Communications Specialist,
j. Center Weather Service
k. Oceanic DAPS,
l. Airborne Warning and Control System,
m. Aircraft Movement Information,
n. Maintenance.

Area Control Computer Complex (ACCC) - That computer complex (hardware and software) of the AAS which provides continuous real-time support of air traffic control of an area assigned to an ACF.

Area Control Facility - A building at which en route and terminal air traffic control is provided and supported by an ACCC.

Area-Level Reconfiguration - Reconfiguration affecting an area's communications and functional capabilities.

Area Map - A correspondence set wherein the communications assignments and control capabilities of an area (predetermined sets of sector suites) within a facility are defined. A correspondence set between the physical maps and configuration maps of grouped sector suites (see Switch Map).

Assembly - A number of parts or subassemblies or any combination thereof joined together to perform a specific function and capable of disassembly.

Assign - A VSCS configuration action that provides specific A/G, G/G communication connectivity capabilities and other communication feature capabilities to air traffic control and ancillary positions.

Assigned Frequency - A frequency in an air traffic control position map made available for use at a position. Frequency assignment implies only the availability of the transmitter and receiver to the position.

Background Mode - In a multi-program system, the condition under which low-priority programs are executed. The execution of data processing operations that are secondary to real-time voice switching and control.

Background Noise - Noise level present on a connected voice circuit.

Backup - Provision for an alternate means of operation in case the primary means is not available.

Back up - The act or process of making a backup.

BUEC (Backup Emergency Communications) - A secondary backup A/G communications network that is independent of primary A/G communications transmission paths and equipment. BUEC is not the same as the backup A/G switch.

Busy - A condition that exists when a called position has an active call in progress and a full CA queue. A call processing tone that is generated when the above condition exists at a called position (G/G only).

Call - A demand to set up a communication connection.

Call Features - Call forwarding, call monitoring, supervisory recording, headset or loudspeaker call routing, call queuing with caller identifications, etc. Types of calls are made in certain modes with certain features invoked; for example, an interphone (type), indirect access (mode), override (feature) call that is monitored (feature) and recorded (feature) by the calling party's supervisor.

Call Forwarding - A switch-provided call feature that permits the user to instruct the switching equipment to redirect G/G calls destined for one position to an alternate position.

Call Modes - Direct access, indirect access, and voice call (G/G only).

Call Transfer - A switch-provided call feature that allows a user to redirect a G/G call that has either been answered or that is in the CA queue at a given position to another position.

Call Types - Intercom and interphone (G/G only).

Calling Line Identification or Caller ID - A switch-provided feature whereby a call source is automatically identified to the called position.

Catastrophic Failure - Failure that is both sudden and complete.

Channel - A communication path providing one-way or two-way transmission between two terminations.

Circuit - (1) A network providing one or more closed paths. (2) An interconnection of electrical/electronic elements. (3) A conductor or system of conductors through which an electrical current is intended to flow.

Classmark - An object program code that enables or disables access to VSCS services and functions. A service classmark enables or disables the class of service with respect to a trunk circuit, mainly its signaling as defined by an Interface Control Document (ICD). An operational classmark enables or disables position access to VSCS communication capabilities.

Commercial Standard - Standard established by a commercial organization or corporate entity governing design, development, documentation, control, manufacture, production, testing, etc., of its commercial and internal products.

Common Answer - A switching function whereby certain G/G calls incoming to a position are directed to a queue to be selectively answered by the position user (also known as automatic call parking).

Common Console - A standardized, human-engineered equipment cabinet including a work surface with provision for physical devices including: main display, interactive display, data entry keyboard, keypad, communications jacks, loudspeakers, and VSCS panel. Various configurations of physical devices provide for air traffic control and ancillary activities.

Complete Failure - Failure resulting from deviations in characteristics beyond specified limits such as to cause complete lack of the function.

Configuration - The arrangement of a computer system or network as defined by the nature, number, and the chief characteristics of its functional elements. The functional or physical characteristics (or both) of systems hardware/software.

Configuration Map - A correspondence set between VSCS hardware elements and software elements based on their chief functional and physical characteristics in an arrangement that provides communications assignments and capabilities through applications of operational and service classmarks (also see Program Control).

Connectivity - An established circuit.

Contrast Ratio - The ratio of the maximum to the minimum luminance values in a display device (color or monochrome).

Control Sector - An airspace area of defined horizontal and vertical dimensions for which a controller, or group of controllers, has air traffic control responsibility. Control sectors are established based on predominant traffic flows, altitude strata, and controller workload. Pilot-controller communications during operations within a control sector are normally maintained on discrete frequencies assigned to the control sector.

Controller - See Air Traffic Controller.

Controller Position - A common console configured for en route or terminal approach air traffic control activity.

Critical Failure - A failure that is likely to result in injury to persons and or significant damage to material.

Cross-Coupling - A switch-provided feature wherein the received voice on one frequency in a pair of frequencies is transmitted over the other frequency of that pair without operator intervention.

Crosstalk Index - The probability, expressed in percent, of a system user hearing one or more intelligible crosstalk words during a call. In the Bell System, for the Loop Plant, the recommended performance objective for network planning and equipment design is that a 0.1% crosstalk index not be exceeded for 99% of the loops in the plant.

Cutover - The final change of operation from the present ARTCC communication systems to the VSCS.

Database - A collection of data fundamental to the operation of a system or enterprise. Database usually connotes a systematized collection of data that can be immediately accessed and manipulated by a system for a specific purpose. Data Bank describes any collection of data that may or may not be interrelated or immediately accessible by a system.

Data Entry Device - Device located at the common console which is used to enter data into the ACCC or the VSCS.

dBm - A logarithmic measure of a power with respect to a reference power of milliwatt (one one-thousandth of a Watt).

$$dBm = (10) \log (P/0.001 \text{ Watt})$$

dBm0 - A logarithmic measure of power (in dBm) at the Zero Transmission Level Point (0TLP) to produce the same power in dBm at another point in the circuit using a 1.0 KHz tone.

dBmC0 - The test tone 1000 Hz power level measured at the 0TLP using a “C” message weighting network.

dBrn - A logarithmic measure of power with respect to a reference power of one picowatt (-90 dBm), used for noise tests.

$$0 \text{ dBm} = 90 \text{ dBrn or } dBrn = (10) \log (P / 10^{-12} \text{ Watt})$$

dBrnC - A logarithmic measure of power relative to a noise reference of -90 dBm as measured with a noise meter weighted by a special frequency function called C-Message Weighting. The interfering effect of noise given in dB above a noise reference of -90 dBm at 1.0 KHz measured with a C-message filter.

dBrnC0 - Noise measured in dBrnC and referred to the 0TLP.

Decibel (dB) - A logarithmic measure of the ratio between two powers.

$$dB = (10) \log (P_2/P_1)$$

Degradation Failure - Failure that is both gradual and partial.

Deselect - An action at an ATC or ancillary position touch entry device or interactive display that results in the deactivation of an A/G communication connectivity at that position.

Deselection - Causing the state of a selected feature of the VSCS to change to not selected.

Designator - A name, entitlement, or distinctive mark intended to point out, assign, indicate, or specify.

Direct Access - A call mode wherein the entire call processing sequence required to establish circuit connectivity is accomplished as the result of a single touch action (G/G only).

Disable - The deactivation of the communication connectivity between the VSCS and the RCE as a result of a DESELECT (A/G only). The deactivation of any VSCS feature or control function.

Disabled Receiver - A receiver, either main or standby, for a selected frequency at an air traffic control position which the position operator has indicated will not be used for the reception of voice at the position. Disabling a receiver at a position does not affect its enabled or disabled status at any other operational position. Equivalent to locally muting the receiver.

Disabled Transmitter - A transmitter, either main or standby, for a selected frequency at an air traffic control position which the position operator has indicated will not be used for transmission of voice from the position. Disabling a transmitter at a position does not affect its enabled or disabled status at any other operational position.

Electronic Patch Panel - Provides a capability of remote access for the purpose of testing and monitoring individual or grouped VSCS voice paths.

E&M - A signaling method for transferring supervisory and control information over a trunk circuit using the signal circuits “E” and “M” leads. The “E” lead transmits into the trunk circuit and the “M” lead transmits into the signal circuit.

Emergency Frequency - See Guard Frequency.

Enable - The activation of the communication connectivity between the VSCS and the RCE as a result of SELECT (A/G only). The activation of any VSCS feature or control function.

Enabled Receiver - A receiver, either main or standby, for a selected frequency at an air traffic control position which the position operator has indicated will be used for the reception of voice at the position. Enabling a receiver at a position does not affect its enabled or disabled status at any other operational position.

Enabled Transmitter - A transmitter, either main or standby, for a selected frequency at an air traffic control position which the position operator has indicated will be used for the transmission of voice from the position. Enabling a transmitter at a position does not affects its enabled or disabled status at any other position.

Erlang - A unit of telephone switch traffic intensity measured in number of arrivals per mean service time. For carried traffic measurements, the number of erlangs is the average number of simultaneous connections observed during a measurement period.

Facility Backup - The act or process of backing up a failed ACF by expanding the controlled sectors of adjacent ACFs to encompass the control sectors of the failed ACF with respect to navigation, surveillance, control and advisory voice and data communications necessary for continued safe air traffic control. Facility backup lies in the AAS/ACCC control domain.

Facility-Level Reconfiguration - A change of communication assignments and control capabilities wherein the modification or changeover occurs with respect to facility maps (also see Facility Backup and Reconfiguration).

Facility Map - A correspondence set wherein the communications assignments and functional capability of an entire facility are defined. A correspondence set between the physical maps and the configuration maps of all sector suites.

Fail Soft - If a failure occurs, that failure will not disrupt the entire system. There may be degradation of service, but basic service will continue.

Fail Soft/Fail Safe - A designed property of an item which prevents its failures being critical failures.

Federal Telecommunications System (FTS) - A leased communications service for use by the U.S. Government.

First Article System - A prototype system upgraded after production award.

First Production System - The initial production equipment.

Fix Posting Area - A volume of airspace, bounded by a series of connected line segments with altitudes, which is assigned to a sector.

Flashing - A visual signal interrupted 60 times per minute with a 50:50 on:off ratio.

Fluttering - A visual signal interrupted 720 times a minute with an 80:20 on:off ratio.

Foot Candle - The illumination on a surface one (1) foot square on which there is a uniformly distributed flux of one (1) lumen.

Foot Lambert - Photometric brightness equal to that of a perfectly diffusing surface emitting or reflecting light at the rate of one (1) lumen per square foot.

Frequency - A part of the radio spectrum used by the FAA to carry communications between controllers and pilots. The spectrum contains ultra-high (used for military air traffic) and very high frequencies (used for civilian traffic).

Frequency Allocation - Designated radio frequency bands for use by specific radio services. Air traffic control frequency allocations used by the FAA are:

118.000 MHz to 135.975 MHz for civilian aircraft
225.0 MHz to 399.95 MHz for military aircraft

Frequency Pair - A combination of VHF and UHF frequencies used as a single radio communication channel.

Full Image - Pertaining to a disk or tape; a faithful likeness of the subject matter on the original.

Functionality - The characteristics of one or more equipments whose configuration provides the capability to perform specified activities.

Functional Path - The set of physical items/equipments necessary to initiate, sustain, and terminate operation of a given function (e.g., radio, IC, or IP).

Grade of Service - The proportion of total calls, usually during the peak busy hour, which cannot be completed immediately or served within a prescribed time.

Gradual Failure - Failure that could be anticipated by prior examination or monitoring.

Guard Frequency - A designated point in the radio spectrum to which radio equipment is kept tuned expressly to monitor for and to make emergency broadcasts. The FAA Radio service uses 121.50 MHz and 243.0 MHz as guard frequencies.

Handoff - Turning over air traffic control of an aircraft from a controller of one sector to another controller of an adjacent sector or terminal.

Handoff Function - Turning over control of an aircraft to another controller or facility.

HOLD - The capability of suspending a call in progress while placing or answering another call.

Human/System Interface - See Man/Machine Interface.

Idle Channel Noise - Noise level present on an unconnected voice circuit.

Indirect Access - A call mode wherein the call processing sequence required to establish a communication link or to select a control function is accomplished by entering multi-digit numbers on a remote keypad. The keypad is activated by selecting the IA mode.

Industry Standard - Standard established by authority of a professional, technical, or industrial organization (association, institute, society, etc.) such as ANSI, EIA, or IEEE.

In-Service Circuits - Those time-shared circuits of the system which achieve a desired grade of service. The failure of one or several will not make the system inoperative, but may degrade the service during peak load.

Intelligible Crosstalk - The speech signal transferred from one voice channel to another which is sufficiently understandable under pertinent circuit and room noise conditions that meaningful information can be obtained by the disturbed party.

Interactive Display Panel - A VSCS display panel that provides access to A/G and G/G communications.

Intercom - A type of call that provides stations (positions) intrafacility communications on a voice switch. Communications between controllers at the same facility.

Intermediate Distribution Frame - A distributing frame used to terminate in-house cabling.

Interphone - A type of call that provides VSCS positions interfacility communications. Communications between controllers at different facilities.

Latching - A function that either is or emulates a pushbutton that locks in the down position upon a first touch, and requires a second touch to release the locked condition. The desired activation is in effect for the time the button is in the locked position.

Line - A family of equipment and devices designed to provide users with access to a choice of communication services and features. A physical channel between the VSCS position equipment and G/G and the VSCS main frame.

Line Circuit - The circuitry required to terminate, convert, and provide transmission, supervisory and control signals at the position side of the interconnection networks, and at the position and/or equipment end instruments. This circuitry can be divided between actual network terminations and position equipment terminations. This includes all circuitry that interfaces the position with the interconnection networks and the common control.

Line Replaceable Unit (LRU) - Any system item that is replaceable at the organizational maintenance level without using any special tools.

Local Muting - The muting by VSCS of voice received from the RCE interface at the operational position activating the muting function for selected frequencies.

Lockout - The inability of one or more users to initiate voice transmission on a given circuit because that circuit is already enabled or in use (see Push-to-Talk).

Logical Position Identifier - An alphanumeric string of 2 to 4 characters for ATC positions and up to 6 characters for other positions types which is used within the VSCS configuration maps to represent a logical position's primary function (e.g., "R44" = Radar controller, Sector 44). The Logical Position Identifier mapped (assigned) to a physical console identifier permits the physical location of a logical position to be uniquely determined.

Logical Map - Map that defines position identification for communications connectivity independent of the position's physical address.

Loop-Back Testing - A standard telephone test procedure involving accessing the circuit at any test access point and sending test signals down the line. The test signals are returned (looped back) to the test access point where diagnostics are then performed on the returned test signals. The loop-back points are located progressively further away from the test access point until either the fault has been detected or the entire circuit has been tested.

Main Distribution Frame - A distributing frame used to terminate leased and Government-owned long-line facilities on the one side and cable pairs for line and trunk equipment terminals associated with a switching system on the other side. The main distribution frame is the interface point used for associating any outside line or trunk with any desired equipment terminal or with any other outside line or trunk. It usually serves as a test point between in-house and outside plant cabling.

Main (or Standby Units) - Units that are operationally critical and are redundantly integrated into the system to achieve a high degree of reliability.

Maintenance Position - The VSCS maintenance workstation (also see Ancillary Position).

MALF - Malfunction signal from BUEC.

Man/Machine Interface - (Pertaining to station control and data acquisition). The operator contact with equipment governed by ANSI IEEE C37. MIL-STD-1472 is recommended as a reference for use in the design and evaluation of the man/machine interface.

Manual Ring - A selective signaling arrangement that consists of a manual ring, generated by the calling party, to alert a specific station on a multidrop circuit in which all stations receive the ringing signal.

Map - To establish a correspondence between the elements of one set and the elements of another set. A correspondence set between elements of one set and elements of another.

Mean Talker Level - Specified at -13.9 dBm0, which is 0.9 dBm less than the maximum voice frequency (VF) signal (average more than 3 seconds) on a standard VF channel and 2.1 dBm more than the VF channel interface standard.

Meet-Me Conference - A conference call in which parties desiring to enter a (pre-arranged) conference call do so by individually accessing the conference feature (e.g., a conference bridge).

Mode - A possible, customary, or preferred way of doing something.

Modular - The extent to which hardware/software is composed of discrete components such that a change to one component has minimal impact on other components.

Module - A limited aggregate of LRUs, data, and contiguous codes that performs independent functions. Typically, modules are used repeatedly in the construction of the system.

Monitor - To listen in on the communications of another controller.

Multiple - Providing more than one connection at a common point.

Multi-point Trunk - A dedicated trunk shared by three or more positions at two or more facilities.

Multi-position Sector - A sector whose control involves the use of more than one common console; typically, it will use two or three adjacent consoles.

Muting - The capability to eliminate receiver output volume on selected air/ground channels.

Muting, Local - See Local Muting.

Muting, Remote - See Remote Muting.

Nonlatching - A feature which either is or emulates a pushbutton that requires an operator to provide continuous touch action to maintain the desired pushbutton activation. The activation is terminated by the release of touch action on the pushbutton.

Off-Hook - One of several line/trunk supervisory signals. Normally a line/trunk state change of idle-to-off indicates a request for service.

Off-Line - (1) An operating condition wherein human action is required between the original recording functions (data recording and storage) and the ultimate data processing functions, including conversion operations, and loading/unloading operations incident to the use of point-to-point or data gathering systems. (2) The operations of a functional unit that are not under the continuous or automatic control of a central or main processing unit.

On-Line - (1) An operating condition wherein input data enters the system directly from the point of origin or in which output data is transmitted directly to where it is used. (2) The operations of a functional unit that are under continuous control of a central or main processing unit.

Operational Configuration - Hardware, communications, functional assignments, and connectivity currently in effect in VSCS.

Operating Position - A manned active position.

Operational Position - A position defined within a configuration.

Outlier - Data point which is not typical of the rest of the data; it may lie three or four standard deviations or further from the mean of the sample.

Outpulsing - Pulsing from a sender.

Override (OVR) - A switch provided call feature whereby a call being placed results in connection to the called party, even if the called position has an active call in progress.

PABX (Private Automatic Branch Exchange) - A private automatic telephone switching system that provides for transmission of calls to and from the public switch telephone network, and private switched or dedicated telephone networks.

Partial Failure - Failure resulting from deviation in characteristics beyond specified limits, but not such as to cause complete lack of the required function.

Physical Console - A specific physical device and/or workstation which includes a set of VSCS console equipment. Examples include an M-1 console, a common console, and the VSCS supervisory workstation. Each physical console has a unique physical console identifier.

Physical Console Assignment Mapping - A correspondence of logical console identifiers to physical console identifiers. The correspondence is such that only one physical console identifier is associated with a logical console identifier.

Physical Console Identifier - An alphanumeric string of up to 8 characters which uniquely identifies a specific physical console. Each physical console has a unique console identifier. From its physical console identifier, the precise location of a physical console can be determined.

Physical Map - A correspondence set of the functional and physical characteristics of VSCS hardware.

Position - A location or piece of equipment at which a person works, e.g., that portion of a sector suite that is normally provided for the use of one ATC person. An M-1 or a common console configured for an air traffic control or ancillary activity.

Position Equipment - The position equipment consists of all VSCS equipment mounted in the console as well as the associated position logic, including its power supply (also see Common Console).

Position-Level Reconfiguration - A change of assignments and control capabilities wherein the modification or changeover occurs with respect to position maps.

Position Map - A correspondence set wherein the communications assignments and functional capabilities of a single position are defined. A correspondence set between the physical map and a configuration map for a single position (also see Switch Map).

Position Roll-In - Combining of communications assignments and functional capabilities required to control a sector at one or more positions of a sector suite.

Position Roll-Out - Distributing communications assignments and functional capabilities required to control a sector among positions of a sector suite.

Preempt - (1) The disconnection and subsequent reuse of part or all of an established connection of lower priority origins by a higher priority source. (2) Jack module preemption is disconnection and subsequent reuse of all the pre-established connections at a position. (3) PTT preemption by frequency classmark is disconnection and subsequent reuse of part of the established connection(s) for use of the frequency.

Preemption Capability - Ability to take over all existing communications channels.

Preset Conference - Same as progressive conference except that conferees will be called automatically by the system when the conference call is requested.

Program Control - The interaction between the software and the hardware of the switching system which determines the time and sequence in which processing occurs. The relationship between a set of instructions and the electronics incorporated into the design of the switching system which enables that system to recognize and perform tasks by interactive user commands or without further intervention by a system user.

Progressive Conference - A conference call in which conferees are successively added to the conference, up to the conference limit, at the discretion of a calling party.

Prototype System - A pre-production model.

PTT Lockout - Condition arising when an attempt is made to transmit on a frequency that is already being used. Transmission will not be permitted to the attempting position unless PTT preemption has been for that frequency.

PTT Preemption - A classmarked capability for a frequency at a position whereby PTT activation from that position will cause seizing of the frequency, locking out all other attempted users including the user just previous to PTT (preemption) activation.

Pulsing - The signaling over the communication path of signals representing one or more address digits required to set up a call.

Pushbutton Action or Pushbutton Operation - The selection of an operation, function, or process by pressing or touching a function key or some display group representing a function key. Pushbutton operation, although in existing equipment refers to the operation of a mechanical switch, has a broader meaning to include such state-of-the-art controls as touch membrane, capacitance touch, touch-entry standards and to meet the reliability maintainability requirements of this document.

Push-to-Talk (PTT) - A method of communication over a speech channel in which transmission occurs in only one direction at a time; while talking the talker is required to keep a switch activated (continuous touch action).

Real Time Quality Control (RTQC) - Real time quality control is the on-line capability of fault detection, isolation, and reporting in real time.

Receiver - Equipment that picks up radio signals sent by transmitters.

Reconfiguration - A change of communication assignments and control capabilities through the modification of the invoked configuration map or through a changeover from one map to another. Reconfiguration can take place at the position, sector, area, and facility levels.

Remote Override - The capability to provide override between two independent systems, VSCS to/from TCS.

Remote Muting - Muting of receivers for selected frequencies. The VSCS will not receive voice from the RCE interface for frequencies on which the remote muting function has been activated.

Resectorization - Redefining and restructuring sectors and the creation of new sectors to support the establishment of new airways and changing traffic patterns.

Return Loss - The return loss at an impedance discontinuity on a two-wire line is the ratio, expressed in decibels, of the level of incident signal to that of its reflected signal. The return loss on a four-wire line is the insertion loss measured between transit and receive pairs with the far end terminated as specified. Echo return loss is a weighted average (on a power basis) of the return loss at all frequencies in the range 500 to 2500 Hz. Single-frequency return loss is the lowest non-weighted return loss in the 0.2 to 3.2 KHz band.

Ringback - A tone that indicates to a caller that a ringing signal is being applied to a called station.

Sector - A volume of airspace, bounded by a series of connected line segments with altitudes defined for the purpose of assigning responsibility for control of aircraft in the airspace (also see Control Sector).

Sector Airspace - One or more contiguous fix posting areas (FPAs) controlled from a single control sector (i.e., the FPAs assigned to a control sector). The sector airspace may overlie or underlie airspace controlled by another sector.

Sector Area - See Sector Airspace.

Sector Combining - Combining of more than one sector's communications assignments and functional capabilities at one or more sector suites.

Sector Decombining - Distributing of combined sector communications assignments and functional capabilities among sector suites.

Sector-Level Reconfiguration - A change of ATC communications assignments and control capabilities wherein the modification or changeover occurs with respect to sector maps.

Sector Map - A correspondence set wherein the communications assignments and functional capabilities of all positions in a sector suite are defined. A correspondence set between the physical maps and the configuration maps of all positions in a sector suite (also see Switch Map).

Sector Suite - A collocated set of one to five common consoles equipped with appropriate sets of data entry and display devices. The set is assigned to one or more controllers working a control sector.

Sector Suite Common Console - Physically identical position workstations within a sector suite which contain the VSCS common console equipment as a primary component.

Select - An action at an ATC or ancillary position touch entry device or interactive display which results in the activation of an A/G communication connectivity at that position.

Selected Frequency - One of an air traffic controller's assigned frequencies which the position operator has indicated will be included in the set of currently operational frequencies to be used for transmission and reception at the position. Connectivity of the transmitter and receiver has been confirmed.

Selective Mode Operation - In this mode, a VHF and UHF assigned to a sector are combined on one trunk. The controller may select VHF only, UHF only, or select both frequencies simultaneously. Using this system, a controller keying one frequency (VHF or UHF) denies the other frequency (UHF or VHF, respectively) to another controller.

Sender - Equipment that generates and transmits signals in response to information received from another part of the system.

Service Circuits - Those time-shared circuits of the system which achieve a desired grade of service. The failure of one or several will not make the system inoperative, but may degrade the service during peak load.

Service F - A communications service comprised of dedicated circuits leased by the FAA.

Sidetone - The acoustic signal resulting from a portion of the transmitted signal being coupled to the receiver.

Single Point Failure - A failure of a single item which has the effect of failing an entire function or functionality.

Signaling - With respect to telephone switching systems; the transmission of address and other switching information between stations and central offices, stations and switching entities, and between switching entities.

Site - Any location where equipment is to be supplied or installed.

Sound Pressure Level (SPL) - An acoustical intensity expressed in decibels above a reference level of 0.0002 dynes/square cm.

Split Mode Operation - The VHF and UHF frequencies of the sector are carried on two different trunks. Thus, there is no contention; PTT lockout affects only the selected frequency.

Standard - Regularly and widely used, available, or supplied; definite rule for measurement of quantity, weight, extent, value, or quality as established by authority.

Subassembly - Two or more parts that form a portion of an assembly or a unit replaceable as a whole, but having part or parts that are individually replaceable.

Subsystem - A combination of sets, groups, etc., that performs an operational function within a system and is a major subdivision of the system.

Sudden Failure - Failure that could not be anticipated by prior examination or monitoring.

Supervisory Position - The workstation for first line supervisor who is typically responsible for less than eight sector suites (also see Ancillary Position).

Support Position - The workstation for personnel supporting air traffic control (also see Ancillary Position).

Switch Map - That portion of a position, sector, area, and facility map that provides the correspondence between the logical connectivities and the physical connectivities within a configuration.

System - The equipment, hardware/software or subsets of two that fulfill the functional requirements of this document.

Support Functions - All functions not listed in Table IX, 3.2.3.1, are support functions for availability considerations.

System-Generated A/G PTT - An A/G PTT signal initiated by the system to support cross-coupling, weather broadcast, and emergency frequency broadcast.

Tactical Special Use Frequency - Each area is assigned one UHF frequency allowing military planes (typically high-performance planes) to change their communication frequency only upon entering a new area as opposed to a new sector.

Telephone Position Circuit - All circuitry required to permit the telephone instrument or headset to access all voice transmission paths terminating at the position.

Transmission Level Point - A signal-measuring point, defined during the transmission system design, where a signal level is specified in relative, but not absolute, terms. 0TLP refers to the zero transmission level point which, in contemporary design practices, is an arbitrary reference along a transmission path. The transmission level at any other point is the nominal design gain (or loss) in decibels relative to zero transmission level at 1.0 KHz. The VSCS 0TLP will be defined by the contractor; the zero transmission level is specified as 0 dBm at 1.0 KHz.

Transmitter - Equipment that sends radio signals to the outside world; these signals are picked up by receivers.

Trunk - A communication channel between two switching systems. A two-wire or four-wire circuit that can be a leased or a Government-owned transmission facility connecting the VSCS with external or remote equipment. The trunk will normally include the protection and isolation equipment when leased facilities are used. A trunk is switch-connected at both ends.

Trunk Circuit - The circuitry being controlled by the VSCS to directly connect with another switching system.

Trunk Group - A number of trunks that can be used interchangeably between two or more switching systems.

Trunk Multi-Point - A dedicated trunk that is shared by three or more positions, at two or more facilities.

Turnkey - Complete single responsibility from start to the point of turning over the final system, ready for operational use.

Type - A particular kind, class, or group.

Type Test - Tests performed to verify that the equipment or system performs over the range of specified service conditions.

Unit - An assembly or any combination of parts, subassemblies, and assemblies mounted together, normally capable of independent operation in a variety of situations.

Utility Program - A computer program in general support of the processes, of computer, e.g., loading, sorting, trace routines, or copying data from one storage device to another.

Voice Call - A call mode wherein initial circuit connectivity is always to the loudspeaker at the called position. Prior to answering, the called party must switch the connection (single touch action) to his or her headset. Voice calling is an overlay mode, that is, it can be used in conjunction with direct access or indirect access modes. Also known as group alerting.

Voice Call Circuit - A special connectivity path for processing voice calls to selected loudspeakers.

VSCS Console Equipment - The complement of VSCS position equipment consisting of the VSCS position electronics box, the indirect access keypad and interactive display unit(s) (panel(s)).

VSCS Interactive Display Panel - A physical device that provides display and control access to the user.

VSCS Numbering Plan - A uniform numbering system wherein all positions with VSCS display panels in an ARTCC/ACF have unique designations similar in form to those of all other ARTCCs/ACFs connected to the NAS Integrated Communication System.

WINKING - A visual signal interrupted 60 times per minute with a 95:5 on:off ratio.

Zip Tone - A 0.2 second burst of dial tone.

10.3 RMA DEFINITIONS

Inherent Availability, A_i - A measure (probability) of the degree to which an item (system) is in an operable and committable state at the start of a mission, when the mission is called for at an unknown (random) time.

$$A_i = \frac{MTBCF_s}{MTBCF_s + MTTR_s}$$

where:

A_i = inherent (designed in) availability
$MTBCF_s$ = mean time between critical failures for the system
$MTTR_s$ = mean time to repair for the system

Operational Availability, A_o - The proportion of time a system is either operating or is capable of operating, when used in a specific manner in a typical maintenance and supply environment. This definition of availability is suitable for defining logistics design goals and scoring methods in field trials. There are two forms of this logistic measurement model shown below; the VSCS analysis should use the form given in (b).

a. The theoretical model, for an ideal reporting environment where all records are kept for all needed measurements, is given as:

$$A_o = \frac{\text{All time when system is operable or operating}}{\text{Total calendar time that readiness was required of a system under control of the operating organization (or possessed time)}}$$

$$= \frac{OT + ST}{OT + ST + TCM + TPM + TALDT}$$

where

OT = total operating time (unit hours) per system
ST = standby time (system is operational, but not in use)
TCM = total corrective maintenance time per system (including diagnostics)
TPM = total preventive maintenance time
TALDT = total administrative and logistics delay time

b. The more realistic version for operational availability is given below:

$$A_o = \frac{\text{Total Possessed Time - Total Down Time}}{\text{Total Possessed Time}} = \frac{\text{TPT - TDT}}{\text{TPT}}$$

or simply

$$A_o = \frac{\text{Total Up Time}}{\text{Total Possessed Time}} = \frac{\text{TUT}}{\text{TPT}}$$

Maintainability - The ability of an item to be retained in or restored to specified conditions when maintenance is performed by personnel having specified skill levels, using prescribed procedures and resources, at each prescribed level of maintenance and repair.

Mean Bench Repair Time (MBRT) - The average time for off-line diagnostics and repair, independent of logistic and administrative delays.

Mean Time Between Failures (MTBF) - The average time between failures of an equipment or item.

$$\text{MTBF} = \frac{\text{Total operating time for all items of a kind}}{\text{Total number of failures for the same items}}$$

Mean Time Between Critical Failures (MTBCF) - The average time between mission failures**.**

$$\text{MTBCF} = \frac{\text{Total operating time}}{\text{Number of mission failures}}$$

Mean Time Between Preventive Maintenance Actions (MTBPMA) - The average time between scheduled preventive maintenance actions.

Mean Time Between Unscheduled Maintenance Actions (MTBUMA) - The average time between failures, when all system elements, including redundant elements, are considered single string and end to end, for reliability parameter (MTBUMA) estimation.

Mean Time To Repair (MTTR) - The average time required to restore a failed equipment or item exclusive of logistic and administrative delay times.

$$\text{MTTR} = \frac{\text{Total corrective maintenance time for all items of a kind}}{\text{Total number of failures for the same items}}$$

Mean Time To Repair for the System, MTTR(s) - The sum of the weighted mean times to repair for the individual items divided by the sum of the individual item failure rates.

$$MTTR(s) = \frac{\text{lambda(1) MTTR(1) + ... + lambda(n) MTTR(n)}}{\text{lambda(1) + ... + lambda(n)}}$$

Reliability - The probability that an item can perform its intended function for a specified interval under stated conditions.

Single-Point Failure - A failure of a single item that has the effect of failing an entire functionality.

10.4 SYSTEM FAILURE

Operational Mission Failure (Critical Failure) - Any incident or malfunction of the system, excluding software defects, which the ATC controller/maintenance crew cannot remedy or repair or reconfigure using the controls, authorized test equipment and tools within a specified time, and which causes one or more of the following:

a. Inability to continue, commence, or cease operation,

b. Inability to accomplish any of the mission-essential functions,

c. Loss of any process essential to any function even though not essential to the specific mission in progress,

d. A critical or catastrophic hazard to personnel or equipment as defined by MIL-STD-882A.

e. Loss of mission-essential functions caused by improper operating or maintenance instructions or inadequate test, measurement and diagnostic equipment (TMDE) or support equipment.

Unscheduled Maintenance Actions - Any malfunction which is either an operational mission failure or results in any unscheduled corrective maintenance action. All operational mission failures are considered unscheduled maintenance actions even if negligible time is actually required for corrective maintenance.

Mission Essential Functions - Functions that the system must be capable of performing in order to accomplish its mission tasks in an acceptable manner.

Equipment or Item - Equipment or item failure is when any part of an item does not perform as required by its performance specification after it has been installed and determined to be operable prior to the event.

Redundancy Switching Time - The time interval between item failure occurrence and the moment when the redundant item(s) is operable.

Preventive Maintenance (PM) - All actions performed in an attempt to retain an item in a specified condition by providing systematic inspection, detection, and prevention of incipient failures. Preventive Maintenance is synonymous to Periodic Maintenance.

a. **System non-interrupting PM -** PM that does not degrade system operational effectiveness,
b. **System interrupting PM -** PM that degrades system operational effectiveness.

Corrective Maintenance - All actions performed as a result of failure, to restore an item to a specified condition.

10.5 TRAFFIC DATA ANALYSIS STATISTICS

Univariate descriptive statistics may include frequency tables, arithmetic mean, standard deviation, variance, mode (values at which the frequency density is at a maximum) and median. Other statistics for a single variable may be included.

a. Generally, univariate descriptive statistics apply to the classes of data listed in the following paragraph numbers:

    1. 3.5.4.2.4.2 a. 1., 4. through 7.,
    2. 3.5.4.2.4.2 b. 1., 2, and 4.,
    3. 3.5.4.2.4.2 c. 3.

b. Frequency distribution and regression/trend analysis are applicable to para. 3.5.4.2.4.2.a.2. Specifically, with time of day and number of calls in system as independent variables, correlate the number of (a) blocked calls, (b) lost calls, (c) delayed calls, (d) uncompleted calls, (e) busy tone terminations, (f) answered calls, and (g) unanswered calls.

c. Distribution and regression analysis are applicable to the following items listed in para. 3.5.4.2.4.a.3 with time of day as one but not necessarily the only independent variable: monitoring, call forwarding, HS/LS selection, brightness, preemption, cross-coupling, results, BUEC selection.

d. The following classes of data listed in para. 3.5.4.2.4.2.b.3 may be analyzed by calculating the following: (a) distribution of the number of calls in the queue as a function of time of day, and (b) regression analysis of time calls are in queue as a function of number of calls in the queue and time of day.

e. Regression analysis is applicable to the following classes of data listed in para. 3.5.4.2.4.2.c: (a) trunk loading as a function of time of day and number of calls in system, (b) trunk overloading as a function of time of day and number of calls in system, and (c) throughput timing as a function of time of day and number of calls in system.

f. Distribution of the following data items listed in para. 3.5.4.2.4.2.d is applicable: (a) frequency of use of reconfiguration function and position relief recording as a function of time of day, (b) occurrence of calls in progress during reconfiguration as a function of time of day, (c) frequency of occurrence of position relief recording as a function of position relief briefing time, and (d) frequency of occurrence of reconfiguration function as a function of reconfiguration time.

g. Computation of the sample correlation coefficient as a measure of the accuracy of estimate is recommended. Analysis of variance may also be applied to distribution calculations.

Trend

A trend is the long-term movement of a time series. One method of determining a trend is the method of least squares.

APPENDIX A

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APPENDIX D

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VOICE SWITCHING AND CONTROL SYSTEM

Attachment J-3

PRODUCT SPECIFICATION

Prototype Upgrade

FAA-E-2731G

Addendum 1

SCN-PSR-016 02 July 1998

5 January 1996

DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

This addendum provides the changes necessary to incorporate the M1/ISSS Essential requirements into the VSCS product specification. Where applicable, the paragraphs identified by this addendum shall supersede the existing paragraphs of the VSCS product specification.

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2.2.3 Other FAA Documents

Document	Title
NAS-IR-61004201	ACF-VSCS
NAS-IR-64024201	VSCS-BUEC IRD
NAS-IR-42009404	VS-PABX IRD
NAS-IR-42014202	VSCS/TCS INTERPHONE IRD
NAS-IR-42004205	VS-REC IRD
NAS-IR-80104201	VSCS-Power IRD
VS-I-03	VSCS-Existing Radio Interfaces ICD
VS-I-01	VSCS-TRUNKS ICD
NAS-IR-44010002	TRANSMISSION EQUIPMENT: ANALOG INTERFACE IRD
FAA Order 1600.54	Security of FAA Automatic Data Processing Systems and Facilities
FSD/VSCS-WP-001.6	VSCS Distribution Frame and Radio Interface Intermediate Distribution Frame Top Level Design
FAA Order 6650.9	Requirements for Area Control Facility (ACF) Under the Floor Cabling
FSD/VSCS-WP-004.1	VSCS Ground-to-Ground Top Level Design
JPL D-4565 Rev E	ICS VSCS to the TSU, JPL D-4561 dated Dec 21, 1988
JPL D-4355	CTSU-TSU ICD dated June 1993
NAS-IR-21014201	VSCS-ACCC, Part 2 (Common Console) IRD

2.5 INDUSTRY STANDARDS

Document	Title
NEC, NFPA-70	National Electric Code 1990

3.1.4 ATC Communication Functions

3.1.4.1 Radio Communications and Control - The VSCS shall provide radio communications switching and the capability to select and control radio transmitters, receivers, and transceivers located at either local or remote radio sites from the ATC positions via the radio interfaces. The required interface will be determined by the contractor at the time of the site survey. The VSCS will be capable of providing all specified functionality, with the exception of the receiver voting algorithm and the PTT Trunk Lockout, with the existing radio interfaces. When the Existing Radio Interfaces do not provide a required input to the VSCS, the required signal shall be generated internal to the VSCS with the exception of receiver voting algorithm and PTT Trunk Lockout.

3.1.4.5 Position Split Functionality Mode Functions - The VSCS shall permit two position operators within a position to plug into different dual jack modules; one accessing G/G voice communications through one dual jack module and the other accessing A/G voice communications through the other dual jack module independently, and on a non-interfering basis.

3.1.9.4 Verification - The VSCS shall have built-in test equipment (BITE) and built-in-test (BIT) software for on-line verification of the system as specified in 3.8, Verification, for the entire system, including position and backroom equipment. Critical parameters shall be measured, recorded, and compared with tolerance limits; a record highlighting out-of-tolerance conditions shall be provided.

3.1.10.1 ATC Operational Training - The VSCS functions and features that support operational training shall include operational monitoring, jack preemption, and operational recording at the supervisory positions.

3.1.10.2 Traffic Data Collection - The VSCS shall provide the capability for on-line voice traffic data collection.

3.2.2.2.1.2 A/G PTT Indicator Response Time - The response time for this event shall be from the instant that a PTT Confirmation Signal is present at the radio interface with the VSCS, to the instant that indicator response is activated at the calling position. For 95% of the event completions, this event response time shall not exceed 75 msec. For 99.9% of the event completions, this event response time shall not exceed 200 msec.

If the radio interface does not supply a PTT confirmation, the response time from this event shall be from the instant the PTT confirmation signal is generated by the VSCS radio interface equipment to the instant that the indicator response is activated at the calling position. For 95% of the event completions, this event response time shall not exceed 75 msec. For 99.9% of the event completions, this event response time shall not exceed 200 msec.

3.2.2.2.1.5 A/G PTT Release Indicator - The response time for this event shall be from the instant that a PTT Confirmation Signal is no longer present at the radio interface with the VSCS, to the instant that indicator response is deactivated at the position. For 95% of the event completions, this event response time shall not exceed 75 msec. For 99.9% of the event completions, this event response time shall not exceed 200 msec.

If the radio interface does not supply the PTT Confirmation Signal, the response time for this event shall be from the instant the PTT release signal is generated by the VSCS radio interface equipment to the instant that the indicator response is deactivated at the position. For 95% of the event completions, this event response time shall not exceed 75 msec. For 99.9% of the event completions, this event response time shall not exceed 200 msec.

3.2.2.2.1.6 Frequency Selection - The response time for this event shall be from the instant a request for a frequency selection is initiated at the position to the instant that the selected assigned frequency is enabled at the position. For 99.9% of the event completions, this event response time shall not exceed 250 msec.

Table III. Setup/Teardown Throughput Timing Requirements During PBH and PBM

Type of Event	Maximum Response Time, msec* Percent of Event Completions		
	95%	99.9%	99.99%
A/G PTT Transmit	25		70
A/G PTT Indicator	75	200	
System-Generated A/G PTT Transmit	75		150
A/G PTT Release Transmit	25		30
A/G PTT Release Indicator	75	200	
A/G Backup Switch Switchover		250	
M/S TX/RX Transfer	75	150	
M/S TX/RX Transfer Confirmation	75	150	
Remote Receiver Muting (A/G Interface)	75	200	
Remote Receiver Muting Confirmation	75	150	
G/G PTT Transmit	75	100	
G/G PTT Release	75	100	
IC Call Placement	250	350	
IC Call Acceptance	200	300	
IC Circuit Release	250	350	
Voice Delay	60	70	
Position-to-Trunk IP Call Placement	200	300	
Position-to-Trunk IP Call Placement (type 5)	250	450	
Trunk-to-Position IP Call Placement	200	300	
Trunk-to-Position IP Call Placement (type 5)	250	450	
Position-to-Trunk IP Call Acceptance	250	350	
Position-to-Trunk IP Call Acceptance (type 5)	250	450	
Trunk-to-Position IP Call Acceptance	200	300	
Position-to-Trunk IP OVR Call Placement Response Time	250	400	
Trunk-to-Position IP OVR Call Acceptance Response Time	300	400	
IC OVR Call Placement/Acceptance Response Time	250	450	
IP Circuit Release	250	350	
Dial Tone for Indirect Access	250	350	
Display Devices			100
TED Detection			50
Radio Squelch Break	25		30
Radio Squelch Break Indication	75	200	
Frequency Selection		250	
Frequency Deselection		250	
Frequency Preemption Activation	25		30
PTT Lockout (Preemption) Busy Tone		250	
Frequency Site Selection		150	
Frequency Site Confirmation		150	
Local Receive Muting Selection		200	

Table III. Setup/Teardown Throughput Timing Requirements During PBH and PBM
(Continued)

Type of Event	Maximum Response Time, msec* Percent of Event Completions		
	95%	99.9%	99.99%
Local Receive Muting Select Indicator		350	
Local Receive Muting Deselection		200	
Local Receive Muting Deselect Indicator		350	
Remote Receiver Mute Deselect		200	
Remote Receiver Mute Deselect Indicator		250	
IA&IA Override Selection (IC)		350	
IC Call Operation Indicator		500	
IC Call Ringback Tone		350	
IC Busy Tone		350	
Conference Call Deselect		350	
Conference Call Indicator		500	
Hold/Resume		350	
Call Forward Select		350	
Call Forward Deselect		350	
Call Forward Select Confirmation		500	
Unacceptable Call Forward Alert		500	
Answer From Common Answer Queue		350	
Confirm Calls in Common Answer Queue		350	
Position Voice Monitor Selection		350	
Voice Monitor Selection Confirmation		500	
Position Split Functionality Mode Enable		350	
Position Split Functionality Mode Enable Indicator		500	
Position Split Functionality Mode Disable		350	
Position Split Functionality Mode Disable Indicator		500	
Position Split Functionality Mode A/G Monitoring Enable		500	
Position Split Functionality Mode A/G Monitoring Disable		500	

- Where applicable, response times exclude TED detection time and display device response times.

3.2.2.2.1.7 Frequency Deselection - The response time for this event shall be from the instant a request is initiated at the position to the instant the selected assigned frequency is disabled at the position. For 99.9% of the event completions, this event response time shall not exceed 250 msec.

3.2.2.2.1.11 Lockout (Preemption) Busy Tone - The response time for this event shall be from the instant that a valid operator PTT action (from the preempting position) is initiated at the position to the instant that the lockout busy tone is available at the preempted position. For 99.9% of the event completions, this event response time shall not exceed 250 msec.

3.2.2.2.3.2 M/S TX/RX Transfer Confirmation Response Time - The response time for this event shall be from the instant that the M/S TX/RX Transfer Confirmation signal is present at the radio interface with the VSCS, to the instant that an indicator response signal is activated at the position that generated the M/S TX/RX selection signal. For 95% of the event completions, this event response time shall not exceed 75 msec. For 99.9% of the event completions, this event response time shall not exceed 150 msec.

If the radio interface does not supply the M/S TX/RX Transfer Confirmation, the response time for this event shall be from the instant the M/S TX/RX Transfer Confirmation is generated by the VSCS radio interface equipment to the instant that an indicator response signal is activated at the position that generated the M/S TX/RX selection signal. For 95% of the event completions this event time shall not exceed 75 msec. For 99.9% of the event completions, this event response time shall not exceed 150 msec.

3.2.2.2.4.2 Remote Receiver Muting Confirmation Response Time - The response time for this event shall be from the instant that the Muting Confirmation signal is present at the radio interface with the VSCS, to the instant that an indicator response signal is activated at the position that generated the remote receiver muting signal. For 95% of the event completions, this event response time shall not exceed 75 msec. For 99.9% of the event completions, this event response time shall not exceed 150 msec.

If the radio interface does not supply a Remote Receiver Muting Confirmation signal, the response time for this event shall be from the instant the Remote Receiver Muting Confirmation signal is generated by the VSCS radio interface equipment to the instant that an indicator response is activated at the position that generated the remote receiver muting signal. For 95% of the event completions, this event response time shall not exceed 75 msec. For 99.9% of the event completions, this event response time shall not exceed 150 msec. Remote Receiver Muting is not used with some existing radio interfaces.

3.2.2.2.4.3 Remote Receiver Mute Deselect - The response time for this event shall be from the instant a request is initiated at the position to the instant that Receiver Remote Muting Deselect signal is present at the radio interface. For 99.9% of the event completion, this event response time shall not exceed 200 msec. Remote Receiver Muting is not used with some existing radio interfaces.

3.2.2.2.4.4 Remote Receiver Mute Deselect Indicator - The response time for this event shall be from the instant that a Receiver Remote Muting Deselect signal is present at the radio interface with the VSCS, to the instant that a visual indication of Remote Receiver Muting Deselection on a specific frequency is received at the position display device. For 99.9% of the event completions, this event response time shall not exceed 250 msec.

If the radio interface does not supply a Remote Receiver Muting Deselect Confirmation signal, the response time for this event shall be from the instant the Remote Receiver Muting Deselect Confirmation signal is generated by the VSCS radio interface equipment to the instant that a visual indication of Remote Receiver Muting Deselection on a specific frequency is received at the position display device. For 99.9% of the event completions, this event response time shall not exceed 250 msec. Remote receiver muting is not used with some existing radio interfaces.

3.2.2.2.4.5 Local Receive Muting Select - The response time for this event shall be from the instant a request is initiated at the position to the instant that the selected frequency audio voice signal is muted at the position. For 99.9% of the event completions, this event response time shall not exceed 200 msec.

3.2.2.2.4.6 Local Receive Mute Select Indicator - The response time for this event shall be from the instant a request is initiated at the position, to the instant that a visual indication of local receiver muting selection on a specific frequency appears on the position display device. For 99.9% of the event completions, this event response time shall not exceed 350 msec.

3.2.2.2.4.7 Local Receive Muting Deselect - The response time for this event shall be from the instant a request is initiated at the position to the instant that the selected frequency audio voice signal is enabled at the position. For 99.9% of the event completions, this event response time shall not exceed 200 msec.

3.2.2.2.4.8 Local Receive Mute Deselect Indicator - The response time for this event shall be from the instant a request is initiated at the position, to the instant that a visual indication of local receive muting deselection on a specific frequency appears on the position display device. For 99.9% of the event completions, this event response time shall not exceed 350 msec.

3.2.2.2.5 Site Selection Response Time

3.2.2.2.5.1 Frequency Site Selection - The response time for this event shall be from the instant a request for change in frequency site selection is initiated at the position to the instant the selected site is enabled. For multiple site frequencies, the response time for frequency site selection shall include the deselection of any previously selected frequency site. For 99.9% of the event completions, this event response time shall not exceed 150 msec.

3.2.2.2.5.2 Frequency Site Confirmation - The response time for this event shall be from the instant a frequency site selection is enabled to the instant a VSCS-generated confirmation of site transfer is received at the requesting operational position. For 99.9% of the event completions, this event response time shall not exceed 150 msec.

3.2.2.2.8.1 IA & IA Override Selection (IC) - The response time for this event shall be from the instant that a valid "IA" keypress on the position IA keypad is initiated to the instant that IA keypad is available for input (regardless of whether OVR or not). This includes clearing of keypad display reset of any previously entered number sequences, and release of any active G/G calls. For 99.9% of the event completions, this event response time shall not exceed 350 msec.

3.2.2.2.8.2 IC Call Operation Indicator - The response time for this event shall be from the instant that a request is initiated at the position to the instant that visual indication of IC call appears on both the originating and terminating position display devices. For 99.9% of the event completions, this event response time shall not exceed 500 msec.

3.2.2.2.8.3 IC Call Ringback Tone - The response time for this event shall be from the instant that a valid address is initiated at the position (IA/DA) to the instant that a ring back tone is connected to the position. For 99.9% of the event completions, this event response time shall not exceed 350 msec.

3.2.2.2.8.4 IC Busy Tone - The response time for this event shall be from the instant that a valid address is generated at the position (IA/DA) to the instant that a busy tone is connected to the position. For 99.9% of the event completions, this event response time shall not exceed 350 msec.

3.2.2.2.14 Radio Squelch Break Response Time - The response time for this event shall be from the instant that the squelch break signal is received at the radio interface of the VSCS to the instant the audio path is set up from the radio interface of the VSCS to the position(s). If the radio interface does not provide a squelch break signal, or when the frequency is selected to BUEC, the VSCS shall interpret the reception of voice signals from the radio interface or BUEC interface as a squelch break and shall set up the audio path between the radio or BUEC interface and the position(s). For 95% of the event completions, this event response time shall not exceed 25 msec. For 99.99% of the event completions, this event response time shall not exceed 30 msec.

3.2.2.2.15 Radio Squelch Break Indication Response Time - The response time for this event shall be from the instant the squelch break signal is received or generated at the VSCS radio or BUEC interface to the instant the squelch break indication is presented at the position(s). For 95% of the event completions, this event response time shall not exceed 75 msec. For 99.9% of the event completions, this event response time shall not exceed 200 msec.

3.2.2.2.16 Conference Call Operation/Conference Call Deselect - The response time for this event shall be from the instant that a valid release action is initiated at the position to the instant that the releasing conference participant voice path is dropped from the conference. For 99.9% of the event completions, this event response time shall not exceed 350 msec.

3.2.2.2.17 Conference Call Indicator - The response time for this event shall be from the instant that a valid operator action is initiated at the position (This action may include a single touch action, entry of appropriate IA function code sequence, or both), to the instant that visual indication of conference call initiation appears on the position display device. For 99.9% of the event completions, this event response time shall not exceed 500 msec.

3.2.2.2.18 Call Hold Operation Hold/Resume - The response time for this event shall be from the instant that valid operator action is initiated at the position, to the instant that the:

a. Held call audio voice path is reconnected to the position (if resume action initiated)
b. Active call audio path is disconnected to position (if hold action initiated).

For 99.9% of the event completions, this event response time shall not exceed 350 msec.

3.2.2.2.19 Call Forward Operation/Call Forward Select - The response time for this event shall be from the instant that valid operator action is initiated at the position, this action shall include either a single touch action to a DA designator, or entry of the destination position number on the IA keypad, to the instant that the call forwarding function is engaged at the position. For 99.9% of the event completions, this event response time shall not exceed 350 msec.

3.2.2.2.20 Call Forward Deselect - The response time for this event shall be from the instant that the valid IA function code sequence is initiated at the position, to the instant that the call forwarding function is disengaged at the position. For 99.9% of the event completions, this event response time shall not exceed 350 msec.

3.2.2.2.21 Call Forward Select Confirmation - The response time for this event shall be from the instant that valid operator action is initiated at the position, this action may include either a single touch action to a DA designator, or entry of the destination position number on the IA keypad, to the instant that the visual confirmation of call forwarding activation appears on the position display device. For 99.9% of the event completions, this event response time shall not exceed 500 msec.

3.2.2.2.22 Unacceptable Call Forward Alert - The response time for this event shall be from the instant that valid operator request is initiated at the position, this action may include either a single touch action to a DA designator, or entry of the destination position number on the IA keypad, to the instant that an alert action (audio or visual) is engaged at the position. For 99.9% of the event completions, this event response time shall not exceed 500 msec.

3.2.2.2.25 Common Answer Queue/Answer From Common Answer Queue - The response time for this event shall be from the instant that valid operator select request of call in answer queue is initiated at the position (either specified call or longest held call), to the instant that the selected held call's audio voice path is available at the position. For 99.9% of the event completions, this event response time shall not exceed 350 msec.

3.2.2.2.26 Confirm Calls in Common Answer Queue - The response time for this event shall be from the instant that valid IA call is placed in the CA queue of the called position, to the instant that a visual indication of incoming IA call appears on the called position's display device. For 99.9% of the event completions, this event response time shall not exceed 350 msec.

3.2.2.2.27 Position Voice Monitor

3.2.2.2.27.1 Position Voice Monitor Selection - The response time for this event shall be from the instant that a valid operator action is initiated at the position, this action may include either a single touch action to a DA designator, or entry of an IA function code and position identifier number, to the instant that the selected position's audio path is available at the monitoring position. For 99.9% of the event completions, this event response time shall not exceed 350 msec.

3.2.2.2.27.2 Voice Monitor Selection Confirmation - The response time for this event shall be from the instant that a valid operator action is initiated at the position, this action may include a single touch action to a DA designator, or entry of an IA function code and position identifier number, the instant that visual indication of voice monitor activation appears on the monitoring position's display device. For 99.9% of the event completions, this event response time shall not exceed 500 msec.

3.2.2.2.30 Position Split Functionality Mode Events and Indicators Response Time

3.2.2.2.30.1 Position Split Functionality Mode Enable - The response time for this event shall be from the instant that the position function is initiated by manual control to the instant the split audio path is established, A/G monitoring is established, an additional legal recorder channel is available. For 99.9% of the event completions, this event response time shall not exceed 350 msec. For 99.9% of the event completions, the indicator response time shall not exceed 500 msec. During enabling of position split functionality mode, a position shall not be without functional communications for more than one (1) second under the traffic loads specified in Tables II and IIa.

3.2.2.2.30.2 Position Split Functionality Mode Disable - The response time for this event shall be from the instant the function is manually deselected or all headsets are removed from either dual jack module, until normal audio path is established. For 99.9% of the event completions, this event response time shall not exceed 350 msec. For 99.9% of the event completions, the indicator response time shall not exceed 500 msec. During disabling of split functionality mode a position shall not be without functional communications for more than (1) second under the traffic loads specified in Tables II and IIa.

3.2.2.2.30.3 Position Split Functionality Mode A/G Monitoring Enable, Resumption - The response time for these events shall be from the instant the A/G monitoring is initiated at a position via any of the following three selection modes:

a. Automatic activation upon enabling position split functionality mode

b. Valid operator single touch action to manually select A/G monitoring while in position split functionality mode

c. Resumption of A/G monitoring by completion of active G/G calls at the G/G dual jack module, termination of override call received at the G/G dual jack module (classmark permitting), or release of PTT action by the position operator plugged into the G/G dual jack module while being overridden,

until the instant the A/G audio voice path is available at the G/G dual jack module and visual indication of A/G monitoring activation is provided at the position. For 99.9% of the event completions, this event response time shall not exceed 500 msec.

3.2.2.2.30.4 Position Split Functionality Mode A/G Monitoring Disable and Suspension - The response time for this event shall be from the instant the A/G monitoring function is deactivated at a position via any of the following three deselection modes:

a. Disabling of position split functionality mode

b. Valid operator single touch action on appropriate VDM page to manually deselect the function

c. Suspension of A/G monitoring by initiating a G/G call, answering a G/G call by the position operator plugged into the G/G dual jack module, receiving an override call by the position operator plugged into the G/G dual jack module (classmark permitting), initiating A/G monitoring while being overridden (classmark permitting), or PTT action by the position operator plugged into the G/G dual jack module while being overridden,

until the instant the A/G audio voice path is unavailable at the G/G dual jack module and visual indication of A/G monitoring inactive or suspended is displayed at the position. For 99.9% of the event completions, this event response time shall not exceed 500 msec.

3.2.2.4 Reconfiguration Timing Requirements - VSCS reconfiguration timing requirements shall be determined based on the two-step reconfiguration process. The time to reconfigure excludes delays caused by positions engaged in active calls. Logical reconfigurations of a position(s) which have temporary modifications in effect are excluded from these timelines. Only positions whose position maps are changed via the reconfiguration shall be counted for the purpose of calculating the allowed timing requirement. The time required to perform any on-line validation necessary to ensure successful completion of the reconfiguration shall be included in the measurement of reconfiguration times.

3.2.2.4.1 RESERVED

TABLE XVII. RECONFIGURATION RESPONSE TIMES

Two-Step Reconfiguration

Stage 1 - Reconfiguration Preparation

Number of Positions Reconfigured	Reconfiguration Times (seconds) *50 Percentile	95 Percentile	99 Percentile
1	4	10	14
2-430	4 + 1 sec/position (300 seconds max)	10 + 1 sec/position (300 seconds max)	14 + 1 sec/position (300 seconds max)

Stage 2 - Reconfiguration Execution

Number of Positions Reconfigured	Reconfiguration Times (seconds) *50 Percentile	95 Percentile	99 Percentile
1 - 20	6	8	12
21 - 430	16	20	24

***** The 50 percentile reconfiguration preparation and reconfiguration execution times shall exclude all other Data Entry Device (DED) activities which may be occurring at the initiator's DED or at other DEDs within the facility; 95 percentile and 99 percentile reconfiguration times shall include such activities.

3.2.2.4.2 Two-Step Reconfiguration Timing Requirements - VSCS shall be capable of performing reconfiguration of communications connectivities in two separate steps, reconfiguration preparation (Stage 1) and reconfiguration execution (Stage 2). The specified time period for Stage 1 shall start when the initiator completes the reconfiguration preparation command and shall end when the initiator receives status indicating that reconfiguration preparation is complete for all affected positions.

The specified time period for Stage 2 shall start when the initiator completes the reconfiguration execution command and shall end when the initiator receives status indicating that the reconfiguration is complete for all affected positions. After the VSCS receives the reconfiguration preparation command, the VSCS shall prepare the requested connectivities for implementation. Upon receipt of the reconfiguration execution command, the VSCS shall execute the called-for reconfiguration. The timing for reconfiguration preparation and reconfiguration execution shall not exceed the times specified in Table XVII, under the traffic loads specified in Tables II and IIa. During reconfiguration a position shall not be without functional communications for more than one (1) second under the traffic loads specified in Tables II and IIa.

Table VIa. Voice Channel Test Limits

Voice Channel	Test Limits
Radio Interfaces Type 4 Trunk Type 4/5 Trunk Type 5 Trunk Type 7 SF Signaling Trunk Type 9 Trunk Type 20 Trunk	-0.5 to +0.6
Type 3 (all except Loop Signaling Trunk)	-1.6 to +2.6
Type 3 Loop Signaling Trunk Type 8 Loop Signaling Trunk	-1.75 to +4.85
Type 6 CO/PBX Extension Trunk	-1.5 to +2.4
Type 7 DX Signaling Trunk	-1.0 to +1.7
Type 7 4-W E&M Signaling Trunk PABX 4-W E&M Signaling Trunk Same Facility PABX 4-W SF Signaling Trunk Different Facility	-1.5 to +1.7

3.2.2.6.11.1 Voice Signal Through Multiple Paths - If, under any operational condition, a position receives the same voice signal through more than one path within the system except due to override or override/monitor loop closure, then the delay between any two of these voice signals shall not exceed 5 msec and the delayed signal(s) shall be attenuated by at least 10 dB for 99.99% of all event completions. If a position receives the same voice signal through more than one path due to audio closure of an override or override/monitor loop, then the delay between any two of these voice signals shall not exceed the product of **x** and **y**, where **x** equals 5 msec and **y** equals the number of positions in the override/monitor conference minus two; the delayed signal(s) shall be attenuated by at least 10 dB for 99.99% of all event completions at those positions receiving delayed voice signals due to audio loop closure.

3.2.2.7 Sidetone - The VSCS shall provide audio sidetone to all (up to four) jacks at a position for all communications emanating from the position. This sidetone shall be generated at the position and shall be such that with the independent sidetone control set to 0 dB and with a test tone of 1004 Hz at a level of -9 dBm injected into the transmit path of the position jack, the level measured at the receive path of the position jack shall be -25 dBm ± 1.5 dB. This sidetone shall be adjustable by the position operator via an independent sidetone volume control. A minimum of 5 levels of adjustment from 0 dB to a minimum level of at least -12 dB shall be provided in increments no greater than 3 dB. The volume control for sidetone shall be independent from all other volume controls. The sidetone shall be provided through the headset or handset and shall not be audible through the position loudspeaker at any time. AGC shall be enabled on sidetone.

3.3.1.1 General Requirements - Each air traffic controller operating position within a facility shall be provided the capability for assignment of A/G communications functions. Assignment of an A/G communications function at a given air traffic controller position shall be controlled by configuration maps as determined by site adaptation data. A/G communications functions shall include, but not be limited to, the following:

a. Selection and deselection of the position's assigned frequencies.

b. M/S transmitter selection for each assigned frequency.

c. M/S receiver selection for each assigned frequency.

d. RESERVED (See Addendum 2)

e. Independent enabling/disabling of transmission for each selected frequency at an operational position.

f. Independent local muting of received voice for each selected frequency at an operational position, for frequencies assigned to split-mode operations by site adaptation data.

g. Remote muting of receivers for selected frequencies.

h. Transmitter/receiver remote site selection for designated frequencies that have radio outlets at more than one remote site.

i. Enabling and disabling of automatic transfer of A/G voice from HS to LS if the operator engages in G/G voice communications.

j. RESERVED.

k. Selection and assignment of BUEC.

l. Selection of UHF or VHF emergency frequencies, or both, for reception or transmission, or both.

m. PTT preemption capabilities for selected frequencies.

n. Manual selection of routing of incoming voice to HS or LS for each selected frequency at a position, for frequencies assigned to split-mode operations by site adaptation data.

o. PTT lockout when A/G transmission is attempted on a frequency that is in use by another position.

p. Visual indication on all assigned frequencies of the presence of squelch break on received voice or PTT confirmation on transmitted voice.

q. Confirmation of PTT, M/S selection, remote and local muting, and frequency selection.

r. Enabling and disabling of radio transfer of A/G voice from HS to LS.

Requirements for each of the above listed A/G communications functions are detailed in the following paragraphs.

3.3.1.1.1 Frequency Selection - Each air traffic controller position that has been assigned A/G communications capabilities shall have the capability to select any frequency or frequencies from those assigned to the position. Frequency assignments for a given operational position shall be resident in the configuration database position map(s). Selection of a frequency that is not in a multiple site group at an operational position shall cause the enabling of either the main or standby transmitter, and either the main or standby receiver, whichever is on line. Selection of a frequency that is in a multiple site group shall function as specified in 3.3.1.1.7.3, Multiple Sites for a Frequency.

3.3.1.1.1.4 Routing of Incoming Voice - The VSCS shall provide for position operator selection of routing of received voice radio communications on each selected frequency to either the position headset/handset or to the position A/G loudspeaker. A visual indication of the voice routing selected for each selected frequency shall be provided. Incoming voice radio communications shall be routed as selected commensurate with the requirements for automatic transfer of A/G voice routing and the radio transfer function (See 3.3.1.1.8 and 3.3.1.1.9).

3.3.1.1.1.6 Frequency Status Display - For each air traffic controller position that has been assigned A/G communications capabilities, the VSCS shall provide access to a frequency status display which provides simultaneous visual indication of real time frequency status for all frequencies selected at that position, up to 24 frequencies. Individual frequency displays shall indicate the frequency value, site designator if multiple sites for a frequency are used, and the selected routing (HS or LS) for the frequency. Frequency status information shall include PTT confirmation, squelch break, PTT lockout and for those radio interfaces that provide a PTT Trunk Lockout signal, a radio interface PTT Trunk Lockout indication. For frequencies with multiple sites, a visual indication of the selected state of the voting algorithm shall be provided for each site group, and a visual indication of the selected state of the frequency site group maintenance function shall be provided for each frequency site. The frequency status display shall have the capability to allow the position operator to select the transmitter site on a call-by-call basis for multiple site frequencies. All other A/G selections and functions shall be activated via the appropriate touch action(s) to the A/G display. The position operator shall have the ability to enable and disable the frequency status display.

3.3.1.1.2.2 M/S Transmitter Selection Method - The assignment of main or standby transmitter for a selected frequency shall require no more than two touch actions. If one touch is used, the position operator shall apply a single touch to toggle the transmitter to change the assignment to main or standby. If two touches are used, the position operator shall apply one touch to a main/standby function touch area, and a second touch to the transmitter touch area of a selected frequency to enable selection of transmitter main or standby. M/S transmitter selection shall function only for frequencies that have been selected by the position operator and are not using BUEC.

3.3.1.1.3.2 M/S Receiver Selection Method - The assignment of main or standby receiver for a selected frequency shall require no more than two touch actions. If one touch is used, the position operator shall apply a single touch to toggle the receiver to change the assignment to main or standby. If two touches are used, the position operator shall apply one touch to a main/standby function touch area and a second touch to the receiver touch area of a selected frequency to enable selection of receiver main or standby. M/S receiver selection shall function only for frequencies that have been selected for use by the position operator and which have not been selected for BUEC.

3.3.1.1.6.1.3 Remote Muting - For radio interfaces that provide remote muting capability, the VSCS shall provide air traffic controller positions the capability to remotely mute received voice for specified assigned frequencies at the air traffic controller position. Selection of remote muting for a frequency shall not effect a frequency deselection for that frequency at any position that has the frequency selected. Remote receiver muting is not used with some existing radio interfaces.

3.3.1.1.6.2 Tracking of Radios in Selective (Paired) Mode - For selective (paired) frequencies, a radio classmark (Selective Mode Transmitter Tracking) shall be defined in the configuration data base such that when enabled, any operational position which has the pair assigned on its A/G screen shall enable both transmitters of the pair when either of the transmitters is enabled. Disabling of transmitters is not affected by selective mode transmitter tracking. The enabling of a receiver in the pair shall enable both receivers of the pair. Likewise, the disabling of the receiver of one member of the pair shall disable both receivers of the pair.

3.3.1.1.7.3 Multiple Sites for a Frequency - The VSCS shall provide the capability, for a given assigned frequency at an appropriately classmarked operational position, to access multiple remote transmitter/ receiver/transceiver sites for that frequency through multiple radio interfaces. For operational positions assigned multiple sites for a frequency, the assigned frequency display shall provide a continuously visible indication of the site for each frequency. The capability shall be provided for one or more operational positions to be classmarked for transmitter site selection for a frequency. At any position with a transmitter enabled for the frequency, or at a position attempting to enable any transmitter for the frequency, the transmitter site selected by any classmarked position shall be displayed as enabled. The VSCS shall provide controls such that only one of the transmitters for the frequency is enabled at a time for all positions having that frequency. A single touch action to a transmitter of a selected frequency/site at a classmarked position shall disable the previously enabled transmitter and enable the selected transmitter. For deselected frequency/sites in a multiple site group, selection of a deselected noncurrent site shall cause the enabling of the main or standby receiver only. A second selection to the disabled transmitter button shall be required to enable the current site transmitter, and disable the transmitter of the previously selected site if the position is classmarked for site selection. Selection of a deselected current site shall enable both the transmitter and receiver with a single touch. For operational positions using this feature, and accessing transmitter/receiver/ transceiver sites via radio interfaces that provide signal strength information, the VSCS shall provide a voting algorithm to preclude mutual interference on received voice from the enabled receivers on the frequency.

When multi-site same frequency receivers do not provide signal strength information, the VSCS shall use squelch break information provided either externally by radio control equipment, or internally by the VSCS, to select the first audio signal received and pass that signal to the operational position while muting all other same frequency signals. The diversity voting feature shall include the following capabilities:

a. Controllers shall be able to manually toggle the voting algorithm ON and OFF, and to select/deselect the audio present at any receiver within the group when voting is disabled. When the voting algorithm has been manually disabled, signal voting shall not resume until the voting algorithm is manually enabled.

b. A visual indication of the selected state (voting algorithm enabled or disabled) shall be provided by diversity group at all affected operational positions.

c. RESERVED

d. When two independent signals from two receive sites are received, the voting algorithm, if enabled, shall pass to the console the audio that caused the first detected squelch break. End of reception from the voted receiver shall cause the present audio from the second receiver to be forwarded to the operational position(s) without the need for additional PTT keying from the second transmitter (aircraft).

e. A visual indication of squelch break shall be provided at the operational position(s) for all receivers that pick up the audio signal, regardless of the state of the voting algorithm.

The capability shall be provided for up to six (6) diversity receiver sites per frequency at each operational position.

f. When at least one frequency of one multiple site group is paired with a frequency in another multiple site group (i.e., sharing a single trunk); enabling/disabling the diversity voting algorithm for one group shall automatically enable/disable it for the other multiple site group.

3.3.1.1.7.3.1 PTT Receiver Muting of Multiple Sites - When PTT is active at the interface for any site, for a frequency configured for multiple sites, the switching function shall completely mute the received radio voice at the interfaces for all sites for the frequency. This function shall also apply when one or more of the sites have been selected for BUEC.

3.3.1.1.7.3.2 Site Group Maintenance - The VSCS shall provide the capability for a VSCS position with multiple site group frequencies assigned to be configured with the capability to independently enable the transmitter(s) of a frequency site(s) within a multiple site group for maintenance purposes with no impact to the current transmitter site selection, other frequency sites in the site group, or other ATC positions with the site group assigned.

3.3.1.1.7.3.2.1 Site Group Maintenance Assignment - The VSCS shall provide the capability for frequency site group maintenance to be assigned on a frequency classmark basis and then assigned to a position via temporary modification reconfiguration.

3.3.1.1.7.3.2.2 Site Group Maintenance Indications - The VSCS shall provide a visual indication to all positions having a frequency site that is selected for site group maintenance for the duration that the frequency site is in maintenance.

3.3.1.1.7.3.2.3 Site Group Maintenance Selection Method - The VSCS shall provide access to the site group maintenance capability. A position operator shall activate the frequency site group maintenance selection function with a single touch action. A visual indication shall be provided that the site group maintenance selection function is enabled. A subsequent touch action to a displayed frequency site shall designate the frequency site as selected for site group maintenance. The site group maintenance selection function shall be disabled if no frequency site selection is made within 15 seconds after the site group maintenance function is enabled. Selection of a frequency site for site group maintenance shall remove the frequency from the diversity algorithm (if enabled) for the multiple site group.

3.3.1.1.7.3.2.4 Site Group Maintenance Deselection - The use of site group maintenance for a frequency site shall be deselected by enabling the selection function and a subsequent touch action to a displayed frequency site with frequency site group maintenance selected.

3.3.1.1.8 Automatic Transfer of A/G Voice Routing - For operational positions with A/G communications capabilities, the VSCS shall provide for the automatic transfer of the routing of incoming A/G voice from the headset/handset to the position's A/G loudspeaker, during those periods when the position operator is engaged in G/G communications, except incoming override calls and outgoing position voice monitor calls, and has also selected incoming A/G to be routed to the position headset/handset, and the receiver is enabled. The position operator shall be provided the capability to enable and disable automatic transfer of routing incoming A/G voice from the position headset(s) to the position A/G loudspeaker. If the automatic transfer of routing incoming A/G voice from the headset/handset to the position's A/G loudspeaker has been disabled, the position operator is engaged in G/G communications using the position headset/handset and has also selected incoming A/G to be routed to the position's headset/handset, and the radio transfer function has been disabled, the incoming A/G voice shall be heard with the G/G voice in the headset/handset. Incoming A/G voice shall be automatically routed to the position A/G loudspeaker at an inactive operational position (see 3.3.3.2, Inactive position). The capability to enable and disable automatic transfer of A/G voice from HS to LS, shall be disabled when a position operator enables position split functionality mode.

3.3.1.1.9 Radio Transfer (R/T) Function - The R/T function shall provide the capability to route all incoming A/G voice at a position to the position's A/G loudspeaker. When enabled, the R/T function shall operate regardless of Automatic Voice Routing or individual A/G frequency HS/LS selections. The R/T function shall also suspend current voice monitors and shall be capable of being enabled/disabled by a controller at any time. The R/T function shall be available to a position operating in split functionality mode but shall only affect the dual jack module dedicated to G/G communication. The effect of the R/T function on a position operating in split functionality mode shall be to automatically suspend the A/G monitor function between the G/G and A/G dual jack modules and to automatically suspend all active voice monitors at the position. The R/T function shall have no effect on incoming A/G communication to a position operating in split functionality mode.

3.3.1.1.9.1 Radio Transfer (R/T) Function Indication - The current selection status of the R/T function shall be continuously visible to the position operator.

3.3.1.1.9.2 Radio Transfer (R/T) Function Selection Method - The R/T function shall be enabled or disabled by a single touch action by the position operator.

3.3.1.1.10.1 BUEC Indications - The VSCS shall provide visual indications of which frequency or frequencies, if any, have been selected for and are using the BUEC system. The position operator shall be provided with a visual display of the BUEC Priority-Level selected by BUEC and in use for servicing A/G communications on each frequency selected for BUEC. The position initiating BUEC access request shall be provided a visual and/or audible alert indication in accordance with the VSCS-BUEC IRD, if BUEC access is requested and is for any reason not available.

3.3.1.1.10.3 BUEC Deselection - The use of BUEC for a selected frequency shall be deselected by a two-touch action. A position operator shall activate the BUEC selection function with a single touch action. A visual indication shall be provided that the BUEC selection function is enabled. A subsequent touch action to a displayed frequency value currently assigned to BUEC shall disable BUEC for that frequency, and disable the BUEC selection function and its visual indication. The BUEC selection function shall be disabled if no frequency designation is made within 15 seconds after the BUEC selection function is enabled. The M/S transmitter and M/S receiver selection status for the frequency shall revert to the current selection status in effect as determined by the VSCS A/G interface.

3.3.1.1.11 Selection of Emergency Frequencies - The VSCS shall provide every air traffic controller position that has A/G capabilities the capability to access the UHF and VHF emergency frequencies of 243.0 MHz and 121.500 MHz. The VSCS shall provide connectivity to the radio interfaces for the emergency frequency transmitters and receivers from all air traffic controller positions that have the emergency frequencies assigned. Each position operator shall be allowed to disable, in any order, all but one assigned VHF and all but one assigned UHF emergency frequency transmitter. Each position operator shall be prohibited from disabling the remaining enabled UHF and VHF emergency transmitter assigned to the position. The position operator shall have the capability of local muting or enabling reception of voice at the position, for either or both emergency frequencies. If emergency frequencies are assigned to any operational positions within an area supervisor's area of responsibility, then that supervisor shall receive an alarm indication when any of the emergency receivers within that area are not being monitored by at least one operational position.

3.3.1.1.12.1 PTT Lockout - Except cases where PTT preemption is permitted by classmark, an attempt by a position operator to transmit on a frequency currently being used for transmission (PTT active) by another position operator shall cause a PTT lockout of that frequency at the attempting position. The position operator at the attempting position shall be provided a visual and an audible indication that the transmission on the frequency has been locked out. A unique PTT lockout visual indication shall be displayed on the frequency(ies) associated with the lockout. The visual indication shall remain for the duration of the lockout. In addition, the frequency(ies) being locked out, to a maximum of four, shall be displayed in any order in the message area for three seconds, unless overridden by a subsequent message. This display shall time out in three seconds. The frequency characteristics of the PTT lockout audible indication shall be as agreed upon by the Government. The PTT lockout tone shall be distinct from the OVR tone and tone accompanying textual messages. The PTT lockout audible indication shall be supplied only to the A/G loudspeaker for the duration of the PTT lockout on that frequency. PTT shall not be locked out on other frequencies selected for transmission at the positions that are not currently being used for transmission by other position operators.

3.3.1.1.12.2 PTT Preemption - Every frequency assigned to an air traffic controller position shall be classmarked as either possessing or lacking PTT preemption relative to that position's use of the frequency. A PTT action by the position operator activating transmission on a frequency designated as preempting shall cause the termination of any transmission in progress on that frequency at any other air traffic controller position. The position operator at a position whose transmission has been preempted shall receive a distinct visual indication on the affected frequency(ies) that preemption has occurred, and shall be provided the preempting conversation(s). Upon PTT preemption, the position operator whose transmission has been preempted shall also receive an audible indication that preemption has occurred. The audible indication shall be rerouted only to the headset. The frequency characteristics of the tone shall be identical to that used for PTT lockout, but the duration shall be as agreed upon by the Government. PTT preemption, if actuated, shall be noncontendable, even by positions processing the same frequency's PTT preemption classmark. PTT preemption as described herein shall be distinctly different from that described in 3.4.9.2.1.

3.3.1.1.12.3 Radio Interface PTT Trunk Lockout - For radio interfaces that provide a PTT Trunk Lockout signal, the VSCS shall provide a distinct visual indication and an audible indication, at an operational position attempting PTT, of a radio interface that is providing the PTT Trunk Lockout signal. A unique PTT trunk lockout visual indication shall be displayed on the frequency associated with the lockout(s). This visual indication shall remain for the duration of lockout. In addition, the frequency(ies) being locked out, to a maximum of four, shall be displayed in any order, along with a trunk lockout message in the message area for three seconds, unless overridden by a subsequent message. This display shall time out in three seconds. The audible indication shall be supplied continuously to the position for the duration that PTT is attempted on that frequency. The frequency characteristics of the PTT trunk lockout audible indication shall be identical to that used for PTT lockout.

3.3.1.1.12.6 PTT A/G Carry Over - Once a PTT has been established for an A/G call, selection of a new transmitter site within a multiple site group without releasing PTT shall cause voice transmission over the newly selected site in addition to all other A/G frequencies with transmitters enabled in accordance with the A/G PTT Transmit response time contained in Table III. Deselection of an A/G transmitter site will be in accordance with 3.3.1.1.7.3.

3.3.2.1 General Requirements - Each operational position within a facility shall have the capability for assignment of G/G communications functions. Assignment of G/G communications at a given operational position shall be in configuration maps as determined by site adaptation data. G/G communications shall include, but not be limited to, the following:

a. Call types:

1. Intercom.
2. Interphone.

b. Call modes:

1. Direct access.
2. Indirect access.
3. Voice calls.

c. Call features:

1. Override.
2. Hold.
3. Forwarding.
4. RESERVED.
5. Conferencing.
6. Common answer (CA) queuing.
7. Call release.
8. Routing of incoming G/G calls to HS or G/G LS.
9. Routing of incoming G/G OVR calls to HS or G/G LS.
10. Recording of position relief briefings.
11. Position voice monitoring.
12. PTT for G/G communications.
13. Manual ring assignment.
14. Call pickup.

Requirements for the G/G communications listed above are detailed in the following paragraphs.

3.3.2.1.2.5 Position Voice Monitoring -

a. The VSCS shall provide the capability in the "ORD software upgrade" to allow any operational position to activate and disable voice monitoring of A/G voice communications only. The monitoring position shall hear all incoming A/G communications for frequencies which have HS routing selected at the monitored position, regardless of the effect of auto transfer of A/G voice routing and all outgoing A/G communications at the monitored position. The monitoring position shall not hear incoming A/G communications for frequencies which have LS routing selected at the monitored position. After the "ORD software upgrade," and prior to the "PPI software upgrade," VSCS shall provide a position classmark (for each logical position) which will permit either A/G voice monitoring, both A/G and G/G voice communication monitoring, or A/G and two-way incoming OVR voice monitor, depending on the classmark activation, and the restrictions of 3.3.2.1.2.5b, 3.3.2.1.2.5.1, 3.3.2.1.2.5.2, and 3.3.2.1.2.5.3.

b. The VSCS shall provide the capability for any operational position to concurrently monitor all voice communications directed to the headsets of up to nine (9) other positions within a facility, and all voice communications transmitted by the monitored position(s) subject to the restrictions in 3.3.2.1.2.5.3. Tones generated locally by the monitored positions(s) shall not be mixed into the monitored voice audio signal(s). Access to position voice monitoring at designated positions shall be defined and restricted by classmarks assigned by authorized supervisory personnel and resident in the configuration database map(s) for the position.

3.3.2.1.2.5.1 Position Voice-monitoring Restrictions - Position voice monitoring of any operational position by any other operational position shall in no way alter or degrade A/G or G/G communications at the monitored position. The operational position being monitored shall receive no visual, audible, or other indication that the position is being monitored. When the monitored position is operating in position split functionality mode, VSCS shall provide the capability to monitor all A/G voice communications, directed to and emanating from the headset plugged into the A/G dual jack module at the monitored position. The operational position monitoring a position operating in position split functionality mode, shall receive no indication that the monitored position is in position split functionality mode.

3.3.2.1.2.5.2 Position Voice-monitoring Access - Access to position voice monitoring at an air traffic controller position shall be provided by DA or IA. DA position voice monitoring shall be provided by a single touch action to an appropriately marked and classmarked DA designator. IA position voice monitoring shall be provided, position classmark permitting, by entering the position voice-monitoring function code, then entering the number of the position to be monitored. Position voice-monitoring shall be suspended if the monitoring position initiates any A/G or G/G communication, answers any G/G communications, or enables the radio transfer function. Position voice-monitoring shall be suspended, classmark permitting, while a monitoring position is overridden or if position voice-monitoring is initiated while a position is overridden. Position voice-monitoring, if selected, shall be resumed after termination of the communication or action causing the suspension. Position voice-monitoring shall not be suspended when the monitoring position receives an incoming A/G call.

Position voice monitoring shall be terminated by individually terminating each active voice-monitoring selection. Additionally, all active voice monitoring selections shall be terminated when the monitoring position becomes inactive. While the position voice-monitoring function is active, the position operator at the monitoring position shall be provided a continuous visual indication that position voice monitoring is in progress, along with the designation of the position being monitored.

3.3.2.1.2.5.3 Position Voice Monitor Loop Closure - The VSCS shall provide internal controls to prevent closure of voice monitored positions. An operational position shall not be permitted to establish a voice monitor that would result in the position being monitored by itself due to voice monitor chaining. When a position that is being monitored attempts to initiate a voice monitor to another position that already has an active voice monitor, that position monitor shall be disallowed and the position operator shall be provided a notice that the voice monitor is not allowed due to monitor loop closure constraints.

3.3.2.1.2.5.3.1 Override/Monitor Loop Closure - When an operational position that has an active voice monitor is overridden by another position, the overriding position shall not hear the overridden position's monitor audio, thus preventing audio loop closure.

3.3.2.2.2 Call Disconnection - Position active calls shall be disconnected by any operator release method defined in the following paragraphs. Additionally, a position active call shall be disconnected when the position becomes inactive, that is when the last remaining voice input device (i.e., headset or handset) is removed from the position jacks.

3.3.2.2.3.2 Latching/nonlatching DA Actions - Each DA selector at an operational position shall be assigned a classmark designating the selector as either latching or nonlatching. A latching selector shall require a touch action to activate the selector; a second touch action or other call release shall be required to deactivate the selector. A nonlatching selector shall require a continuous touch action to initiate and maintain activation of the selector; cessation of touch shall deactivate the circuit. A continuous visual indication shall be provided showing that a selector is latching or is nonlatching. Activation of a nonlatching selector shall activate the position microphone for the duration of the touch action.

3.3.2.2.3.5 OVR Call Indications - The VSCS shall provide an audible tone and a visual indication of an incoming OVR call at an operational position. A visual indication and an identical audible tone shall be provided to the position operator at the called position for any additional incoming OVR calls. In the case that a position is overridden by six (6) or more positions, the overridden position's override list shall display the caller IDs of the first five (5) overriders in the order in which the OVR calls were received. When one or more of the first five (5) overrides releases, the override list shall be updated to include the override caller ID(s) of the next overrider(s) as determined by the order in which the calls were received. The VSCS caller ID(s) of the overriding caller(s), up to five (5), shall be displayed at the called position for the duration of the OVR call(s). The frequency and duration of the OVR tone shall be as agreed to by the Government. The VSCS shall provide a distinct visual indication of an active override to all positions with the OVR DA button for the primary designator of the called position. This visual indication shall be provided for the duration of the override call.

3.3.2.2.5 Call HOLD - The VSCS shall provide the capability for a position operator to place a position active call, including conference calls but excluding OVR and voice calls in a HOLD status with a single touch of the HOLD area. The position operator shall be provided a continuous visual indication of the call indicator at the operational position that a call is in a HOLD status for the duration of time that a call is on HOLD. A CA queue call placed on HOLD shall retain its position in the CA queue. An IA call placed on HOLD shall be moved to the CA queue providing that a CA queue space is currently unused; otherwise, hold shall be denied, and appropriate notification shall be given to the position operator.

3.3.2.2.8.6 Conference Features - For progressive conference calls, an indication shall be provided to the conference initiator when the conference limit is reached. For progressive conference calls, the VSCS shall terminate the call attempt to any party that does not answer within a suitable timeout period. Audio ringback shall be provided to the originator of a progressive conference and shall terminate when any one conferee answers the call. For any type conference, an indication shall be given to any position operator attempting a conference when no system conference resources are available.

3.3.2.2.9 Voice Calls - The VSCS shall provide the capability for designated operational positions to initiate voice calls by DA, or by entering an appropriate IA function code sequence. Incoming voice calls shall be heard on the G/G LS at all those operational positions that are on the voice call circuit. A unique, distinct visual indication identifying the voice call shall be provided on a DA selector at each called position on the voice call circuit. Access to voice call circuits shall be as determined in the position configuration map(s) from site adaptation data. Operational positions shall be provided the capability to enable and disable incoming voice at the G/G LS (i.e., the voice page) on any or all individual voice call circuits assigned to the operational position. Enabling or disabling of the voice page for a voice call circuit at one position shall not affect receipt or routing of audio on an active voice call circuit (i.e., after an incoming voice call is answered). Enabling or disabling a voice page shall be performed via selection of a function key on the interactive display, followed by a touch to the desired voice call DA. A visual indication of the enabled or disabled voice page shall be provided on the DA selector.

3.3.2.2.13 Call Pickup - The VSCS shall provide the capability for a position operator to answer incoming IP calls from appropriate trunks, which are directed to another position. The position operator shall be able to answer from either a DA or from the IA Keypad at the operator's own position, in order to terminate ringing at the called position.

3.3.3.2 Inactive Position - An operational position within a given configuration shall be considered inactive for input when no voice input devices (i.e., headset or handset) are plugged into the VSCS jack module. Where no conflict exists with the control of multiple-position requirements, the interactive display, the IA keypad, PTT switches, and all other VSCS input devices shall be functionally inoperative at an inactive operational position.

With the exception of display brightness, all interactive display selections or parameters which can be controlled by the position operator shall remain set at the values last selected and in place at the time the position became inactive. The interactive displays at an inactive position shall continue to display visual status of on-going communications (e.g., squelch break, PTT confirmation, incoming calls, trunks-in-use, calls forwarded) and position selections (e.g., call routing, frequencies selected for use, BUEC selections) in a manner which is identical to that used when the position is active. Incoming A/G and G/G calls directed to an inactive position shall be automatically routed to the position's A/G and G/G loudspeakers, respectively. When a position with the voice monitoring function and/or the radio transfer function enabled becomes inactive, these functions shall be disabled.

3.3.3.7 Status of IA Initiated Events - Status of calls and VSCS functions shall be displayed continually to the position operator. In particular, status of calls or functions initiated via IA shall be continuously visible, until no longer applicable, regardless of subsequent IA actions. Status of IA initiated calls or functions shall be depicted on the originator's Interface Display Unit (IDU), rather than IA keypad display, if subsequent IA entries are possible for the duration of time the status remains valid. Examples of such conditions include an IA call placed on hold and an IA initiated monitoring session.

When a call for which the originator has a corresponding DA is requested via IA, call status to the originator shall be provided on the IDU in a manner that is consistent with that provided when the request is originated via the DA. Similarly, when a VSCS function for which a function key is provided on the IDU is initiated via IA, feedback to the originator shall be provided on the IDU in a manner consistent with that provided when the function is selected via the IDU.

3.3.3.9 Position Split Functionality Mode - The VSCS shall provide the capability to divide a position's voice communications such that one dual jack module is dedicated to all A/G communications and the other dual jack module is dedicated to all G/G communications. While in position split functionality mode, a position operator plugged into the A/G dedicated dual jack module shall have the capability to independently access A/G communications, and a position operator plugged into the dedicated G/G dual jack module shall have the capability to independently access G/G communications, on a non-interfering basis. There shall be no interaction between the dual jack modules while in position split functionality mode. Normal jack preemption and sidetone shall apply within a dual jack module.

3.3.3.9.1 Position Split Functionality Mode A/G Communications

3.3.3.9.1.1 General Requirements - While in position split functionality mode, the position operator plugged into the A/G dual jack module shall be provided at a minimum, with the A/G communications functions identified in paragraph 3.3.1.1 a. - r.; with the exception that the requirement in paragraph 3.3.1.1 i to provide the capability to enable and disable automatic transfer of A/G voice from HS to LS if the operator engages in G/G voice communications, shall be disabled when a position operator enables position split functionality mode. At a minimum, VSCS shall also provide the capability of recording of A/G position relief briefing, as a special A/G feature while in position split functionality mode as described in 3.3.3.9.2.1.1.

3.3.3.9.2 Position Split Functionality Mode G/G Communications

3.3.3.9.2.1 General Requirements - While in position split functionality mode, the position operator plugged into the G/G dual jack module shall be provided at a minimum, with the G/G call types, call modes, and call features identified in 3.3.2.1 with the exception of position relief briefing which will be modified to separately provide A/G and G/G position relief briefing. At a minimum, while in position split functionality mode, VSCS shall also provide the capability for A/G monitoring by the G/G dual jack module, and shall also provide the capability of recording a G/G position relief briefing as a special feature, while in position split functionality mode, as described in 3.3.3.9.2.1.2.

3.3.3.9.2.1.1 Position Split Functionality Mode A/G Position Relief Briefing - The VSCS shall provide for the recording of A/G position relief briefing between the position operator going off duty at the A/G dual jack module and the operator assuming duties at that A/G dual jack module. While the position relief briefing recording function is active, all transmit and receive audio of the two operators plugged into the A/G dual jack module at the position shall be recorded in accordance with the VSCS-REC IRD (see 3.6.9). Activation of the A/G position relief briefing shall in no way interfere with incoming or outgoing A/G transmissions at the A/G dual jack module. During A/G position relief briefing, audio sidetone shall be provided to both jacks at the A/G dual jack module. The prerequisite
for activation of A/G position relief briefing recording at the A/G dual jack module shall be two (2) headsets/ handsets plugged into the A/G dual jack module. The position relief briefing shall then be activated by a single touch action by a position operator. A continuous visual indication shall be provided for the duration of the A/G position relief briefing. A/G position relief briefing recording shall be deactivated by a single touch action by a position operator or by the removal of one headset/handset from the A/G dual jack module.

3.3.3.9.2.1.2 Position Split Functionality Mode G/G Position Relief Briefing - The VSCS shall provide for the recording of G/G position relief briefing between the position operator going off duty at the G/G dual jack module and the operator assuming duties at that G/G dual jack module. While the position relief briefing recording function is active, all conversation between the two operators plugged into the G/G dual jack module at the position shall be recorded in accordance with the VSCS-REC IRD (see 3.6.9). Activation of the G/G position relief briefing shall in no way interfere with incoming or outgoing G/G transmissions at the G/G dual jack module. During G/G position relief briefing, audio sidetone shall be provided to both jacks at the G/G dual jack module. The prerequisite for activation of G/G position relief briefing recording at the G/G dual jack module shall be two (2) headsets/handsets plugged into the G/G dual jack module. The position relief briefing shall then be activated by a single touch action by a position operator. A continuous visual indication shall be provided for the duration of the G/G position relief briefing. G/G position relief briefing recording shall be deactivated by a single touch action by a position operator or by the removal of one headset/handset from the G/G dual jack module.

3.3.3.9.2.1.3 Position Split Functionality Mode A/G Monitoring - The VSCS shall provide the capability for the position operator at the G/G dual jack module to monitor all A/G communications emanating from or directed to the headset plugged into the A/G dual jack module. Access to A/G monitoring shall be automatically established when position split functionality mode is enabled. The position operator shall have the capability to disable and enable the function by a single touch action. A/G monitoring shall be suspended when the position operator initiates or answers a G/G call. A/G monitoring shall be automatically suspended, classmark permitting, while a monitoring position is overridden or if A/G monitoring is initiated while a position is overridden. A/G monitoring shall be automatically resumed upon termination of the communication that caused the suspension. Continuous notification shall be provided at the position of active, suspended, and inactive A/G monitoring.

3.3.3.9.3 Position Split Functionality Mode Activation/Deactivation - Position split functionality mode shall be available at a position which has both A/G and G/G communications assigned. The prerequisite for activation of position split functionality mode at a position shall be at least one headset/handset plugged into the A/G dual jack module and at least one headset/handset plugged into the G/G dual jack module. Position split functionality mode shall be activated by either one touch action to the valid key when on appropriate VDM page by either position operator**,** or by entering an IA keypad special function. A continuous visual indication shall be provided at the position for the duration of the activation of position split functionality mode. Position split functionality mode shall be disabled by the following methods.

a. One touch action to the valid key on the appropriate VDM page by either position operator.

b. Removal of all headsets/handsets from one dual jack module by either position operator (if two controllers are plugged into one of the dual jack modules, both must unplug to disable split functionality mode).

c. LTP reconfigurations, or logical reconfiguration for positions whose A/G or G/G classmarks are being removed. VSCS shall not disable position split functionality mode at positions which are logically reconfigured but which retain classmarks for both A/G and G/G communications. The disabling of position split functionality mode shall not precede the implementation of the execution stage of the reconfiguration.

d**.** Entering an IA keypad special function.

When enabling or disabling split functionality mode, at a minimum, all incoming communications will be retained. Notification shall be provided to the supervisor when position split functionality mode is enabled or disabled.

3.4.2.3.2.1 Display Capability at an Operational Position - The display device shall be capable of concurrently displaying at least 12 radio frequencies, including emergency frequencies if assigned to the position, with their associated status and control areas. The display shall be capable of concurrently displaying the number of assigned DAs or a minimum of 25, whichever is less, DA status and control areas (with access to at least 50 DA status and control areas), the CA queue, and G/G communications feature control areas (e.g., HOLD, release, transfer). Each operational position shall indicate the position's logical identifier on the device's utility (default) screen. In cases where two or more positions have been combined, only the primary logical position identifier shall be displayed at the operational position. When a position is unused (i.e., spare or unmapped), no position identifier shall be displayed.

The display shall be visible under all ambient light conditions in the control room areas as defined in FAA-ER-130-005H-AP. The display device shall be a color device capable of displaying at least eight (8) colors simultaneously. The display device shall be capable of imparting coding information by means of color, size, shape, brightness, intensity, and blink of displayed areas, and change(s) thereto in any combination.

3.4.2.3.3.1 IA Keypad Pushbutton - The IA keypad device shall provide a telephone-type pushbutton, 12-key IA keypad with a 3 by 3 plus 1 numeric matrix with the zero digit centered on the bottom row between '*' and the '#' symbols, and a call initiation pushbutton, a release pushbutton, and a backspace pushbutton for correcting erroneous entries. The call initiation and release pushbuttons shall be translucent and continuously transilluminated and placed above the numeric keypad at a distance from the numeric keypad greater than that between rows of the numeric keypad. The "5" key shall have a distinct indication to reflect a "home" position. The 12-key pushbuttons shall be transilluminated when the IA keypad is active for input. Distinct colors shall be used to indicate the functionality of the pushbuttons. A brightness control for the pushbutton backlighting shall be provided for the operator's use.

3.4.2.3.3.3 Installation - The IA keypad device shall be connected to a VSCS position via a twist-lock plug on a nonfouling connector cable having a minimum length of 24 inches. The IA keypad device shall have maximum dimensions of three inches wide by five and one-half inches deep by one and three-quarters inches high. The alphanumeric display shall provide at least one row of at least 20 characters, or at least two rows of at least 14 characters each, and shall be an integral part of the IA keypad. The IA keypad device shall be designed such that it may be temporarily fixed in place at the position operator's discretion.

3.4.2.3.7.2 Tone Volume Control - The volume for all audible feedback tones, except externally supplied tones, shall be adjustable by the position operator. A minimum of three distinct volume levels, as approved by the Government, shall be provided.

3.4.5 Supervisory Positions

The VSCS shall provide for operational positions to be designated as area supervisory positions. Area supervisory positions shall have the same G/G communications capabilities as those provided to air traffic controller ATC operational positions. The area supervisor shall have supervisory monitoring capabilities, the capability to record position operator communications, and the capability to initiate VSCS communications reconfigurations within the supervisor's area of responsibility.

3.4.5.1 Supervisory Position Equipment - Each area supervisory position shall have VSCS C/C equipment and have access to cassette recording devices as specified in 3.4.5.2.2, Supervisory position voice recording and playback. Each area supervisory position shall have a data entry device for systems management functions as specified in 3.5.4, System Management Functions.

3.4.5.2.2 Supervisory Position Voice Recording and Playback - The VSCS shall provide each position classmarked for supervisory functions with the capability of selecting, for the monitoring of communications, up to six ATC positions to be recorded on a cassette recording device or devices. The VSCS shall provide for those supervisors to select playback, through console headset/handset or loudspeaker, of any cassette on any of the cassette recording devices accessible to the position. VSCS shall provide the capability to record A/G communications at a minimum, of a position in position split functionality mode operations.

3.4.5.2.2.1 Supervisory Position Voice Recording and Playback Equipment - The VSCS shall provide a cassette recording and playback device or devices capable of simultaneously recording the monitored communications of up to six ATC positions per supervisory position, with each ATC position's communications being recorded on a separate cassette. The recording and playback device or devices shall accommodate commercially available cassettes that are capable of at least 60 minutes of recording time. the recording device shall have a voice-operated switch (VOX) recording capability.

3.4.5.3 Supervisory Control of Position Reconfiguration - The area supervisory position shall be provided with the capability to initiate VSCS communications reconfiguration for operational positions within the supervisor's designated area of responsibility. The area supervisory position operator shall have the capability to make temporary modifications to assignments and classmarks in position maps for operational positions for contingency purposes. LTP reconfigurations shall retain temporary modifications of the reconfigured position(s). When the area supervisory position requests a logical reconfiguration that will reconfigure a position(s) whose current map(s) has (have) been temporarily modified, the initiator shall be provided with a display of the position(s) with temporary modifications. The modifications in effect at each such position shall be provided in sufficient detail to permit the requester to determine the differences in A/G and G/G resources and classmarks between the current modified position(s) configuration and the unmodified (i.e., DEO-created) version of the position(s) map(s) in effect.

The area supervisory position shall have the capability to selectively retain previously implemented temporary modifications for logical positions that are logically reconfigured. If the initiator elects not to retain previously implemented temporary modifications, the logical reconfiguration shall eliminate these modifications. It is not the intent of sector-, area-, or facility-level reconfigurations to alter temporary modifications at positions where the position map is not changed.

3.4.6 Local Maintenance and NAS Manager Positions

The VSCS shall provide for operational positions to be designated as the facility local maintenance and NAS Manager positions. They shall be provided with A/G and G/G communications capability and, in addition, shall have the capability to request, control, display, store, and transfer on-site system tests and test results. All built-in test equipment (BITE) and built-in testing (BIT) shall be accessible from these positions. Distribution and protector frames shall be in close proximity to the maintenance position. Patching facilities shall be accessible from the local maintenance position.

3.4.6.1 Local Maintenance Position Equipment - In addition to the console equipment defined in 3.4.9.2, the local maintenance position equipment shall include a programmable test panel and interface ports to support digital/analog test signal generators, and other external test equipment required to accomplish tests, measurements, and verifications of the parameters specified in 3.2.2. The local maintenance position shall provide dual concurrent and independent A/G and G/G communication capability.

3.4.6.2 Local Maintenance and NAS Manager Theory of Operation - The local maintenance and NAS Manager positions shall augment the VSCS BITS/BITE to provide a comprehensive automated maintenance workstation. It shall provide the software and hardware tools required to meet the operations and maintenance criteria necessary to make possible the availability, grade of service, and reliability requirements set forth in this document. Implementation and operability shall follow methods that are well established in commercial industry applications of automated test equipment, using standard test equipment data busing and measurement techniques (IEEE-488, and current Bell System Technical References (BSTRs)).

3.4.6.3 NAS Manager Position Equipment - In addition to the console equipment defined in 3.4.9.2, the NAS Manager position shall be provided with a data entry device and a hardcopy printer device.

3.4.6.3.1 NAS Manager Position Features - The VSCS shall provide a means to read and store the results of built-in test sequences (BITS), prepare and run extended sequences of parametric tests, select positions or whole sector suites to test/validate the equipment functionality (entry/display, switching/control, special features), select and connect lines/trunks to perform line service verification, loop maintenance tests, and switching system performance tests. Built-in test equipment (BITE) shall be used to support BITS, parametric tests, and automated test sequences set by the NAS Manager position operator.

3.4.7 Data Entry Position

The VSCS shall provide for at least one or more positions to be designated as a data entry position that has the capability to access the VSCS configuration database, VSCS performance data, traffic analysis data, and system communication status data. Data entry position access to the VSCS database shall not perturb or impede the real-time data and communications processing requirements of the VSCS. The data entry position shall be assignable to an appropriately equipped position.

3.4.7.2 Data Entry Position Software - Software shall be provided to enable a data entry position to access and manipulate the VSCS configuration database commensurate with the requirements of real-time VSCS communications traffic analyses as defined in 3.5, Switching and Control Functions. Access to the VSCS internal data shall be through an interactive computer-human interface approved by the FAA and described and documented in the Human Factors Design Document.

3.4.8 Reconfiguration Command Entry and Display

The VSCS entry/display function shall support reconfiguration to all levels specified in 3.5.4.1.1.3, Reconfiguration levels. The entry/display function shall accept position configuration map data from the control function and shall display implemented map data as directed by the control function. The VSCS shall accept reconfiguration commands from designated supervisory positions, the local maintenance and NAS Manager positions only. Each position with reconfiguration authority shall have the scope of its reconfiguration authority defined by classmark. Authorized personnel shall be able to initiate a reconfiguration of the VSCS by entering the reconfiguration command and logical configuration group or position map(s) to be implemented.

3.4.8.1.3 Limitations of Reconfiguration - Reconfiguration processing at an operational position shall establish position selections as follows.

3.4.8.1.3.1 Limitations of Logical Reconfigurations - For positions logically reconfigured, but whose physical console assignment is unchanged:

a. Frequencies gained by the logical position shall default to frequency off, while the remaining frequencies (i.e., those frequencies at the position prior to the reconfiguration) shall remain in the state selected by the position operator prior to the reconfiguration, including voice routing selections.

b. Voice call DAs gained by the logical position shall default to voice page on, while the remaining voice call DAs (i.e., those at the position prior to the reconfiguration) shall remain in the state selected by the position prior to the reconfiguration.

c. All other position-selectable options shall remain in the identical state in effect at the logical position prior to the reconfiguration.

3.4.8.1.3.2 Limitations of Logical-to-Physical (LTP) Reconfigurations - For positions whose physical console assignment is changed (i.e., those logical positions moved to a different VCE via an LTP reconfiguration), regardless of whether the logical position is concurrently logically reconfigured:

a. Settings specified in 3.4.8.1.3.3 shall apply.

b. All frequencies shall default to transmitter off, receiver on, and a contractor-selected voice routing default.

c. All voice call DAs shall default to voice page on.

3.4.8.1.3.3 Unmapped Console Functional Settings for Reconfiguration - For physical consoles going to an unmapped state (e.g., previously assigned logical position is combined/rolled into another position, or is eliminated in a LTP reconfiguration), the settings for the unmapped console shall be:

Page display:	Utility Screen
G/G Voice Routing:	LS for OVR, LS for Non-OVR
Keyclick:	OFF
Auto Xfer:	ON
R/T Function:	OFF
Sidetone Volume:	Maximum (0 dB Attenuation)
Tone Volumes:	Medium (applies to all volumes set via the interactive System Tones and OVR Tone displays)
HS/LS Volume:	Previously selected level
Chime State and Volume:	Previously selected state and level
Display Brightness Setting:	Previously selected level

3.4.8.1.3.4 A/G System States for Reconfiguration - For any reconfiguration, BUEC, main/standby selection, remote mute, and cross-couple for each frequency shall remain in the current system state. Reconfiguration of a position with the capability to select a frequency site for site group maintenance shall remove the frequency site(s) from site group maintenance. A frequency site(s) shall display the site group maintenance status after a reconfiguration.

3.4.8.1.3.7 Position Split Functionality Limits for Reconfiguration - The VSCS shall disable the position split functionality mode at positions which undergo an LTP reconfiguration. VSCS shall not disable position split functionality mode at positions which undergo a logical reconfiguration unless the reconfiguration removes the classmark for either A/G or G/G communications. When a reconfiguration disables split functionality mode, the disabling of position split functionality mode shall not precede the implementation of the execution stage of the reconfiguration. It is not the intent of reconfiguration to disable the position split functionality mode for positions whose position map is not changing. Reconfiguration of a position with position split functionality mode enabled shall not disrupt calls in progress at either the A/G dual jack module or the G/G dual jack module.

3.4.9.2.1 Position Headset/Handset/PTT Jacks - The VSCS shall provide two dual jack modules for each common console. Each jack module shall be capable of accommodating any combination of two headsets or handsets and their associated PTT switches. One jack on each jack module shall provide PTT preemption capabilities. The second jack shall be preemptable. The functionality of the two jack modules shall be in accordance with CTA-211-V-0208-91, Interaction of the Dual Jack Modules. The jack power and jack module shall be compatible with headsets/handsets as specified in 3.4.2.3.8.1. Each jack (total of four) shall be supplied with its own volume control capable of adjusting the audio output level over a range of +15 dB to -27 dB relative to the nominal level of -25 dBm. Limiting shall be such that no signal greater than -20 dBm (RMS) shall be allowed to the headset, regardless of the volume control setting except as defined in 3.4.9.2.1.1. The volume controls shall be as specified in NAS-IR-21014201 (Part 2) VSCS to ACCC (Common Console) IRD.

3.4.9.2.1.1 Headset Limiting Transient Response - Headset output limiting shall be such that from the onset of a sudden receive input level increase from -19 dBm0 to + 6 dBm0, the instantaneous headset output level shall be within ± 1.0 dB of -20 dBm (RMS) within 100 msec ± 20 msec. Headset output limiting shall be such that from the onset of a sudden receive input level decrease from + 6 dBm0 to -19 dBm0, the instantaneous headset output level shall be within ± 1.0 dB of -20 dBm (RMS) within 500 msec ± 100 msec. These tests shall be performed with the headset volume set to maximum and AGC disabled.

3.4.9.3.4.2 Provision for One LS - The design of the VSCS and the VSCS C/C shall not preclude using only one LS at a position for both A/G and G/G communications reception. All references to A/G loudspeaker and G/G loudspeaker in this specification shall then be construed as referring to a single-position LS.

3.4.9.3.4.3 LS Performance - In this specification, the term "loudspeaker" shall mean off-the-shelf loudspeaker unit, the loudspeaker enclosure, any associated circuitry, and any internal acoustical absorbent material. Loudspeakers, whether provided or driven by VSCS, shall have a nominal impedance rating of 4 or 8 ohms and an input power rating of 5 watts continuous at 8 ohms. The actual loudspeaker impedance may range from 2.50 to 35 ohms over the frequency range of 200 Hz to 3000 Hz when driven by a constant voltage amplifier having a frequency response flat within one dB. The loudspeaker when driven by VSCS shall meet the speech intelligibility measurement requirements of 3.4.2.3.8.4 at one-half the full volume setting. Loudspeaker grill material shall be of an acoustically transparent material.

3.4.9.3.5 Chimes - A chime device shall be provided for each VSCS common console to alert the operator to incoming G/G communications. The chime device shall be capable of generating five distinct chime tones. The device tones shall be selectable for a given physical console position by the data entry operator through site adaptation data; the console position operator shall not be allowed the capability of changing the tone. The chime device audio shall be available to the position operator through the position G/G loudspeaker.

3.5.1.4 G/G Interface Compatibility - The trunk and PABX G/G interfaces shall be such that the G/G interfaces may interchangeably be installed in the same circuit location.

3.5.1.5 A/G Interface Compatibility - The radio interfaces shall be such that the A/G interfaces may interchangeably be installed in the same circuit location.

3.5.2.1.1.1 Assigned Frequencies - Operational positions shall access A/G capabilities through radio or BUEC interfaces. The frequency assignments shall be defined in the position configuration map(s). The capability shall be provided to assign access for up to 24 unique frequencies to any operational position. The VSCS design shall not require emergency frequencies to be assigned to an operational position. A facility VSCS shall be capable of simultaneous A/G connectivities as indicated in Table XI. The flexibility shall also be provided to assign a smaller number of A/G connections to a larger percentage of positions than is shown in Table XI. The system shall minimize the occurrences with which a reconfiguration is denied due to an A/G connectivity (Table XI) resource violation by optimizing the allocation of A/G connectivity resources. Any assigned frequency at an operational position is capable of being activated through selection for transmission, reception, or both.

3.5.2.1.1.3 Fan-out Feature - The switching and control functions shall be capable of managing access to the radio interface or the BUEC interface from up to 12 assigned positions to any given interface so that only one position is capable of transmission on the interface at any one time. All positions with that frequency assignment shall receive transmission status signals. The number of positions capable of being simultaneously assigned to A/G interfaces shall be as specified in Table XII. There shall be no degradation in signaling time or in voice quality as a result of this fan-out feature.

3.5.2.1.1.4 Multiple Locations of a Frequency - For each frequency through the VSCS, a capability shall be provided to assign A/G operational positions access to multiple radio interfaces and BUEC interfaces. The VSCS shall be capable of providing independent voice and control to assigned operational positions, except as required by 3.3.1, A/G Communications. This independence shall result in a frequency being assigned multiple times, with each frequency functioning as a distinct frequency. When a frequency is configured for this mode of operation, as determined by the site adaptation data, the receiver voting algorithm shall not be active.

Table XI. A/G Connectivity

Percentage of All Positions	Maximum Number of Connectivities Assigned to a Position at One Time
40	0
20	4
13	6
14	10
9	14
3	18
1	24

Note: The number of positions shall be the integer greater than or equal to the product of the percentage and the number of positions in the facility.

Table XII. A/G Fan-in and Fan-out

Percentage of all Interfaces	Maximum Number of Positions Assigned with the Fan-in Feature	Maximum Number of Positions Assigned with the Fan-out Feature
60	6	6
40	12	12

Notes: (1) The number of interfaces shall be the integer greater than or equal to the product of the percentage and the number of A/G interfaces in the facility.

(2) This table does not include interface for emergency or tactical frequencies where the 12 positions per interface shall always be available.

3.5.2.1.2.3 PTT and Voice Transmission - VSCS transmission over a frequency shall be controlled by PTT keying at an operational position with the frequency selected for transmission. The VSCS shall provide PTT signaling at the radio interface for the frequency while PTT is engaged. The VSCS shall inhibit simultaneous PTT keying on each frequency interface. The switching function shall provide PTT signaling to the radio interface when PTT on a frequency is recognized, shall provide voice transmission, and shall expect PTT Confirmation from those radio

interfaces that provide PTT Confirmation. For existing radio interfaces that do not provide PTT Confirmation, the VSCS shall generate them internally. The VSCS shall recognize a continuous PTT confirmation from the radio interface while receiving the PTT confirmation signal. The VSCS shall continue to generate the internal PTT confirmation signal for the existing radio interfaces so long as PTT is being sent to these interfaces. The switching function shall provide the PTT confirmation to the originator of the PTT, shall enable a PTT lockout capability to all other positions that have selected the frequency, and shall provide a squelch break signal, or equivalent, to all positions that have the frequency assigned that shall indicate that voice transmission is occurring. An alert shall be provided to the maintenance and NAS Manager positions when PTT confirmation is expected but is not received from the radio interface within one second.

When PTT is released, appropriate signaling, control, and status shall be similarly distributed to the radio interface and to all positions with the frequency assigned.

3.5.2.1.2.4 A/G Voice Reception - The switching function shall recognize a squelch break signal from the radio interface that provides a squelch break signal and shall provide that signal to all positions that have the frequency assigned. For BUEC interfaces and radio interfaces that do not provide a squelch break signal, the VSCS shall recognize voice signals from the interfaces as squelch break and shall internally generate the squelch break signal. The presence of the squelch break signal is to indicate that the receiver has been activated and is receiving a radio signal.

3.5.2.1.2.5 Activation of Radio Interface Control Changes - When a frequency has been selected at a position, the switching function shall recognize requests for change in state for M/S control and receiver remote muting. After a request for a change in state is recognized, the switching function shall apply the proper signaling at the radio interface. Upon confirmation of the change in state from a radio interface that returns confirmation, the switching function shall provide a confirmation signal of the change to all positions that are assigned the frequency. For radio interfaces that do not return confirmation, the VSCS shall generate these confirmations internally and provide them to the positions for display. For all interfaces, the position visual indications shall provide status in accordance with 3.3, Operational Requirements.

3.5.2.1.3.2.2 Malfunction Indication - Upon receiving the malfunction indication, MALF, from the BUEC interface, only the position that initiated the BUEC select command for the frequency and the area supervisory position shall receive an alarm to indicate the BUEC access malfunction. The switching function shall automatically assume a BUEC deselection.

3.5.2.2.2 VSCS Switch Features - The switching and control functions shall include, but not be limited to, the following VSCS features:

a. Calling source identification.
b. Direct access.
c. Direct access with override.
d. Indirect access.
e. Indirect access with override.
f. Conferencing.
g. Voice call.
h. Call forwarding.
i. RESERVED.
j. Call hold.
k. Voice routing.
l. Call pickup.

3.5.2.2.2.3.1 Calling Party IA - An indication shall be provided to the display function in response to a request for IA connectivity. A valid dialed code shall cause the necessary connectivity to be established to the called position. The call shall be directed to the called position's DA or CA feature as specified in 3.3.2.2.4.4. If an invalid number is dialed, an interrupted constant frequency tone shall be sent to the calling party by the terminating switch for IP calls and the error message tone shall be sent to the calling party by the local switch for IC calls, which shall continue until the IA call is released by the calling position.

3.5.2.2.2.4 OVR - The VSCS shall establish the connectivity for an IC or IP OVR call between calling and called parties with no actions being required by the called party to answer the call. The OVR connectivity shall be in addition to any current communication connectivity at the called position. The OVR calling party shall join in any ongoing G/G communications at the called position. The OVR calling party shall receive, over the OVR voice channel, except where in conflict with 3.4.9.2.1, all A/G communications emanating from the called position, and all A/G and G/G communications directed to the called position that are routed to the called position's HS, subject to the restrictions in 3.3.2.1.2.5.3.1 and 3.5.2.2.2.4.10. The OVR calling party's voice shall not be transmitted over the called position's A/G communications.

When the overridden position is operating in position split functionality mode, the OVR calling party shall receive the following A/G and G/G communications:

a. All G/G communications emanating from or directed to the overridden position's G/G dual jack module that are routed to the called position's HS plugged into the G/G dual jack module.

b. When A/G monitoring is active (enabled but not suspended), all A/G communications emanating from or directed to the overridden position's A/G dual jack module that are routed to the HS plugged into the G/G dual jack module.

3.5.2.2.2.4.1 OVR Signaling - After the connection has been made, an audible signal shall be provided to both the calling and called positions to indicate that the OVR connection is complete. The audible signal shall be for all override calls.

3.5.2.2.2.4.6 Simultaneous OVR - The capability and resources shall be provided by the VSCS for any operational position to be simultaneously overridden by up to five other positions, or by one less than the simultaneous OVR limit, whichever is greater. If any of the parties overriding a single position are themselves being overridden, all parties shall be connected to form one composite OVR conference call, subject to the simultaneous OVR conference limitation and 3.5.2.2.2.4.10.

3.5.2.2.2.4.7 Simultaneous OVR Conference Limitation - The limit of the number of positions involved in a simultaneous OVR shall be at least six (6), including the overridden position. A capability shall exist within the VSCS for at least 32 simultaneous OVR conferences.

3.5.2.2.2.4.10 Override Loop Closure - The VSCS shall provide internal controls to prevent audio feedback due to closure of chained override calls involving three (3) or more positions. Position-to-position override calls shall not be permitted to form a closed audio loop with other positions. When a position operator at the operational position attempts to initiate an override call that would result in loop closure the VSCS shall break any audio paths that will result in audio feedback in the loop. Two party override loops shall be prohibited provided the denied overrider receives notification of the reason for denial.

3.5.2.2.2.10 Voice Routing - The switching and control functions shall provide voice routing for position monitoring, supervisory recording, voice recording, HS/LS selection, and position relief briefing recording.

3.5.2.2.2.10.2 Supervisory Recording - The connectivity shall be provided by the switching function for position voice recording. The supervisory position shall have the capability of selecting a monitored position for recording. Each monitoring connection established shall be capable of being recorded. The switching function shall provide for selectively recording up to six monitored connections at each supervisory position. The switching function shall provide the connectivity and signaling for selection of a specific recording for playback.

3.5.2.2.2.10.3 Voice Recording - Two recorder channels shall be provided at each position at all times. One recorder channel shall record all voice signals (i.e., all A/G communications and G/G communications including the position briefing) on all circuits entering and leaving the position. The other channel shall record all incoming and outgoing A/G communications at the position. At each position, both channels shall be connected directly to the Government Furnished Equipment (GFE) legal voice recording system. The combining point shall be prior to any Volume Controls and the output shall be - 10 dBm with a nominal Test Tone into an interface point on the Jack Module. Other requirements for the voice recording interface shall be as specified in the VSCS-REC IRD (see 3.6.9). Upon activation of position split functionality mode operations, one recorder channel shall separately record voice signals of the dual jack module dedicated to G/G communications, and the other recorder channel shall record voice signals of the dual jack module dedicated to A/G communications.

3.5.2.2.2.11 Call Pickup - The switching and control functions shall provide, for the appropriate IP trunks, the ability for incoming calls directed to a position to be answered by another position from either a DA or from the IA Keypad, in order to terminate ringing at the called position.

3.5.2.2.3.4 Selective Signaling - The switching and control functions shall provide the capability to both receive telephone calls and originate calls to existing systems equipped with selective signaling systems. The switching and control functions shall make the necessary code translations to be compatible with the numbering plan used in the 300 system. The switching and control functions shall include the capability to emulate all signals for IP trunks to interface existing systems.

3.5.3.1.1.1 Supervisory Positions - The VSCS shall include supervisory positions. Supervisory positions shall have access to control that includes, but is not limited to, requesting reconfiguration, establishing training positions, modifying the on-line functional capabilities of positions, monitoring performance, and requesting special monitoring or playback functions.

3.5.3.1.1.2 Maintenance and NAS Manager Positions - The VSCS shall include both maintenance and NAS Manager positions. These positions shall have access to controls that will provide capabilities to perform all diagnostics and verification actions as described in 3.8.

3.5.3.2 Status Monitoring and Control - The monitoring of real-time system performance, the reporting of system status and failures, and the local maintenance and NAS Manager control over system resources to facilitate continuation or restoration of VSCS operational service shall be provided to support RTQC. The status monitoring and control functions shall be consistent with the reliability and maintainability requirements in 3.7, and meet the maintenance functions in 3.1.9

3.5.3.2.2 Performance Status Monitoring - A real-time system performance monitor shall be provided to monitor system equipment status and report failures for dissemination to maintenance NAS Manager and supervisory personnel. Results from periodic self-tests of equipment and indication of equipment failures shall be provided. This shall comprise, at a minimum, test reports on equipment, processors, memory, peripherals, internal interfaces, radio trunks, interfacility trunks, and the BUEC interface. Data paths shall be monitored by error detection and correction programs to ensure the integrity of transmitted messages. The data communications interfaces to external systems shall be monitored.

3.5.3.2.2.1 Performance Reporting - System equipment status, the detection of system failures, and the recovery measures taken shall be reported to the maintenance position and NAS Manager and the supervisory positions as classmarked.

3.5.3.2.2.1.1 Reports to Maintenance and NAS Manager Positions - System status shall be available at a 5-second periodic rate. Status output shall be selectable. In the event of a failure, an indication identifying the failed equipment, its relationship to the system, and a way of maintaining the level of availability shall be provided. Audible and visible alarms indicating the failure status shall be provided. Failures shall be categorized, prioritized, and stamped with time of detection in terms of Greenwich Mean Time (GMT). Where audible alarms are used a muting capability shall be provided. All failure alarms shall be maintained until the problem has been resolved. Recovery alternatives shall be selectable.

3.5.3.2.2.1.3 Reports to Supervisory Positions - Supervisory positions, as classmarked, shall be notified of a change in status or of position equipment failures within their area of supervision within one (1) second of detection. Other conditions which shall result in a supervisory status update shall be as specified in 3.3 and 3.5. Additionally, critical status updates shall be available without supervisory action. Critical status updates are defined as those related to position equipment failures, or reconfiguration failures which impact operations within the supervisor's scope of responsibility.

At the request of AT supervisory personnel, a summary view of the current VSCS operational status, as it applies to the supervisor's scope of responsibility, shall be provided. Summary status shall provide the area supervisor and the area manager with an at-a-glance summary of all operational alerts and failures that are applicable to their areas.

3.5.3.2.2.2 Failure Logging - All failures as reported to the maintenance and NAS Manager positions shall be logged and stored. The capability shall be provided to format failure reports and select output data according to, at a minimum, date, time, and equipment type for display and hardcopy output.

3.5.3.2.3 Control - Automatic switchover to redundant equipment, as available, shall be provided in the event of a failure. The recovery time shall be within limits specified in 3.7.2, Reliability. The maintenance and NAS Manager positions shall be provided the capabilities required to control the recovery from system failures, the execution of diagnostics, and the output resulting from the monitoring function.

3.5.3.2.3.1 Failure Recovery - In the event of system fault or failure, recovery shall be initiated automatically by switching to redundant equipment or circuits. The recovery time shall be within limits specified by 3.7.2.3, Redundancy. In the event of the degradation of the A/G primary communications switch, the VSCS shall provide for the automatic switchover to the A/G backup switch as defined in 3.5.2, Switching and Control Functional Requirements, and in accordance with 3.2.2, Performance. The maintenance and NAS Manager positions shall have the capability to initiate manual recovery procedures to maintain system performance by reconfiguring the system around the problem areas. Regardless of the methods or techniques used to accomplish fault recovery, the VSCS shall return from failure in the exact configuration, including all temporary changes, in effect prior to the failure. Failures shall be reported, and recovery options shall be selectable.

3.5.3.2.3.2 Diagnostic Control - The maintenance and NAS Manager positions shall have the capability to initiate diagnostic testing for failure isolation. The maintenance and NAS Manager positions shall have the capability to establish any connection that can be provided to operational positions.

3.5.3.2.3.3 Reporting Selection Control - The maintenance and NAS Manager positions shall have the capability to select real-time status reports on tests. The status reports shall be selectable, at a minimum, by equipment types. Status shall be reported for operational and nonoperational equipment indicating, at a minimum, on-line, off-line, standby, and malfunctioning equipment. The maintenance and NAS Manager positions shall have the capability to select hardcopy output for all selectable status reports and failure reports.

3.5.3.3 On-line/Off-line Diagnostics - Diagnostics for self-testing, failure detection, and isolation shall be provided in both the on-line and off-line mode. Diagnostic test results shall be monitored and, in the event of a detected failure, reported to supervisory positions, as classmarked and the maintenance and NAS Manager positions for appropriate corrective measures.

3.5.3.3.1 On-line Diagnostics - Built-in automatic self-testing of VSCS equipment shall be provided as specified in 3.8.2. Fault and failure detection and isolation shall be to the lowest replaceable unit level. All faults, failures, and recovery attempts shall be reported with alarms to the maintenance position, NAS Manager position and supervisory positions, as classmarked. Manual self-testing initiated for position equipment and loop-back testing shall be provided. Performance monitoring and fault and failure reporting for manual self-testing shall be as for automatic built-in self-testing.

3.5.3.3.2 Off-Line Diagnostics - The capability shall be provided to the maintenance and NAS Manager positions to initiate automatic and manual diagnostic procedures for off-line equipment. Off-line equipment is that equipment which is currently not part of the operating system due to either automatic switchover to backup equipment or equipment out of service due to reconfiguration. Diagnostics shall be for fault and failure isolation to the lowest replaceable unit in accordance with the verification requirements in 3.8. Diagnostics test results shall be reported to the initiating position.

3.5.3.3.3.1 Maintenance and Supervisory Position Interfaces - Centralized access shall be provided to supervisory positions, as classmarked, and to the maintenance position and NAS Manager position for requesting diagnostics, reporting results, and initiating recovery procedures.

3.5.4.1.1.1 Configuration - A facility will have configurations mapped out to operate under different sets of conditions. Configurations shall be comprised of physical maps defining the hardware configurations of a facility, logical configuration maps defining the communications and functional assignments of all positions within a facility, switch maps defining the desired connectivity for the switching hardware, and a physical console assignment mapping which assigns the physical locations for ATC positions defined in the VSCS configuration maps. Position configurations define the logical communications assignments and classmarks restricting communications and functional capabilities for operational positions. Sector configurations are the logical groupings of position configurations. Area configurations are the logical groupings of position and sector configurations. Facility configurations are the logical groupings of position, sector, and area configurations. Within the VSCS logical configuration maps, logical console identifiers shall be used. The purpose of logical console identifiers is to permit the maps to reference an individual logical position without specifying the physical location of the position, that is, without specifying the physical console identifier. For each logical console identifier contained within a configuration map, the physical location of that console shall be specified in the physical console assignment

mapping in accordance with 3.5.4.1.1.1.4. Physical console identifiers shall be up to a four character alphanumeric string which uniquely identifies the physical location of a console on the control room floor; at a minimum, the physical console identifier shall be at least one alpha and one numeric character. Physical console identifiers shall be site adaptable and shall be the only console identifier used for the Area Supervisor and Area Manager position data entry and display. The logical console identifier shall consist of two (2) to four (4) characters for Air Traffic Control positions and up to six (6) alphanumeric characters for other position types. Definitions of logical position identifier and physical console assignment mapping are contained in 10.2, Definition and Terms.

3.5.4.1.1.1.4 Physical Console Assignment Mapping - The physical console assignment mapping is a data structure which defines the correspondence of logical console identifiers to physical console identifiers. See 10.2 for definitions of relevant terms. This assignment shall define the physical console locations for the logical console identifiers defined in the VSCS configuration maps. When a VSCS logical reconfiguration has been requested, the display and switching function shall use the physical console assignment mapping to complete the configuration map data and switch map data required for the reconfiguration. Unless otherwise specified by the initiator, the current physical console assignment mapping shall be used by the system.

Table XIII. Classmarks

For an operational position:
A/G capabilities and displays Reconfiguration initiation authorization Data access authorization Alarm/alert reporting Access to operational reports
For A/G communication capabilities:
Selective/split operations Transmitter/receiver site selection Selective mode transmitter tracking BUEC access M/S transmitter selection M/S receiver selection Remote receiver muting PTT preemption RESERVED
For G/G communications capabilities:
DA call override IA call override Conference call initiation Position voice monitoring Voice monitor - suspend on override Position voice monitor recording PTT for G/G communications Access to and from PABX and PSTN Latching/nonlatching type of call activation Voice monitor mix

3.5.4.1.1.1.4.1 Physical Console Assignment Mapping Creation and Display - The physical console assignment mapping shall be created off-line and downloaded to the operational system as part of the configuration map database. Once downloaded, the system shall allow authorized personnel, via the data entry device, to view the current (i.e., including on-line modifications) or original (i.e., DEO-created, excluding on-line modifications) physical console assignment. It shall be possible to request to view the physical console assignment for the facility or for designated area(s) of responsibility, sector, or position. The user shall have the option of selecting the assignments ordered by logical console identifier or physical console identifier. The capability shall exist to store (in the on-line database) up to 25 physical console assignment mappings, one per facility map. Under a given facility map hierarchy, the capability shall exist to perform a Logical-to-Physical (LTP) reconfiguration to reinstate the original physical console assignment mapping for the facility or for an individual area. At the initiator's option, it shall be possible to request this LTP reconfiguration with or without a concurrent logical reconfiguration (i.e., with or without returning to the default lower level logical maps associated with the facility or area map hierarchy). Additionally, changes to the mappings may be made via on-line modifications in accordance with 3.5.4.1.1.1.4.2.

3.5.4.1.1.1.4.2 Physical Console Assignment Mapping Modifications - The physical console assignment mapping may be modified on-line. The capability shall be provided to modify the physical console assignment through the VSCS data entry devices. The system shall permit modifications to the current physical console assignment in effect. Additionally, when an LTP reconfiguration is requested to reinstate the original physical console assignment mapping, the initiator shall have the option to make modifications prior to executing the reconfiguration (e.g., to account for a VCE outage). Access to this capability shall be defined by classmark. The Area Manager may modify the physical console assignment for any logical console identifier. Area Supervisors may modify only those physical console assignments for logical console identifiers within their area(s) of responsibility. Modifications shall not be lost upon subsequent logical reconfigurations, and shall remain in effect until altered by a subsequent LTP reconfiguration. However, no modifications shall alter the original (i.e., DEO-created) mapping stored in the configuration database. Only the installation of a new configuration database may alter the stored maps. In the case of a failure, the system shall recover to the physical console assignment mapping in effect prior to the failure. A modification to the physical console assignment mapping may modify the physical console assignment for any number of logical console identifiers, up to the facility maximum. Only modifying the physical console assignment for a single logical console shall be used to transfer an existing logical console to any unused (i.e., unmapped or spare) physical console, for example, in response to a console failure (i.e., a VSCS console failure or the failure of non-VSCS console equipment). The user shall be able to view the desired changes prior to executing the changes. Upon command by the initiator, the system shall download the appropriate position maps to the affected consoles, adjust the switch map in accordance with the requested modifications, and execute the reconfiguration. Timing performance shall be in accordance with 3.2.2.4. The number of sequential modifications which may be made to the physical console assignment mapping shall be unlimited. Overlapping or simultaneous modification requests shall be handled in accordance with 3.5.4.1.2.5 and 3.5.4.1.3.1.

3.5.4.1.1.1.4.3 Unmapped Logical Positions - The VSCS configuration map database may define more logical positions than the number of VCEs. The system shall not require a logical position to be assigned a VCE while the logical position is not in effect (i.e., while the logical position is unmapped). Prior to downloading a new configuration map database to the on-line system, the off-line system shall validate that, for each facility map, every logical position defined in the facility map's default hierarchy is assigned a VCE in the associated physical console assignment mapping. When a logical and/or LTP reconfiguration request will result in implementing a previously unmapped logical position(s) (sector and/or ancillary position), the on-line system shall validate that the initiator's requested physical console mapping assigns a VCE to every logical position to be implemented by reconfiguration.

3.5.4.1.1.1.5 Physical Console Assignments - The VSCS shall provide the capability to assign physical consoles (i.e., VCEs) to specific physical aisles for the purpose of displaying ATC supervisory status.

3.5.4.1.1.3.1 Position-level Reconfiguration - Position-level reconfiguration shall be provided to permit the selection of a different position map for an existing, previously assigned logical position. The capability shall be provided to add or delete position communications assignments and to modify classmarks for any operational position. The transfer of position communications assignments to any unused (i.e., unmapped or spare) physical console shall be performed via an appropriate modification to the physical console assignment mapping, as specified in 3.5.4.1.1.1.4.2.

3.5.4.1.1.3.2 Sector-level Reconfiguration - Sector-level reconfiguration provides for the assignment of communications capabilities required for sector control to individual positions within a sector suite. For example, a position would have A/G communications capabilities, and another position would have G/G communications capabilities. The capability for sector-level reconfiguration shall be provided to support sector roll-in and sector roll-out. Sector roll-in is the combining of sector communication capabilities at a sector position, and sector roll-out is the distributing of communications capabilities among the sector positions. For a sector-level reconfiguration, only those positions within the sector whose position map is changing shall be reconfigured.

3.5.4.1.1.3.3 Area-level Reconfiguration - Area-level reconfiguration shall be provided to support combining and decombining of individual sector communications capabilities. Usually two or three adjoining sectors are combined into a single larger sector and controlled from a single sector suite during light traffic periods. This larger sector is then decombined to individual sector suites during busy periods.

3.5.4.1.1.3.4 Facility-level Reconfiguration - Reconfiguration on a facility level shall be provided to support a shift change affecting more than one area within a facility. Facility-level reconfiguration shall also be provided to support the combining and decombining of sectors over area boundaries, system initialization, and facility backup. Facility backup will be achieved by expanding the airspace controlled by facilities surrounding a failed facility. Facility-level reconfiguration shall also support the entire resectorization of airspace, establishment of new air-ways, and the creation of new sectors. It is not the intent of every facility-level reconfiguration to reconfigure every area, sector or position within the facility (e.g., a facility reconfiguration performed to alter the map hierarchy due to allocation of A/G connectivity (Table XI) resources). At the option of the reconfiguration initiator, the system shall implement only the requested changes and leave all other positions unaffected, that is, in the configuration in effect prior to the reconfiguration.

3.5.4.1.2 Reconfiguration Process - The VSCS shall perform reconfiguration at the supervisor's option. The reconfiguration process shall provide the capabilities to perform a logical reconfiguration (i.e., facility-, area-, sector-, or position-level reconfiguration) a logical-to-physical reconfiguration, or a combination of a logical and a logical-to-physical reconfiguration. For example, it shall be possible to request a single reconfiguration which combines two sectors, rolls out a third sector (e.g., to add another position) and change the physical console assignment for a non-sector ATC position.

3.5.4.1.2.3 Reconfiguration Initiation by Supervisory Positions - Authorized supervisory positions shall be provided the capability of initiating changes to the physical console assignment, facility-level reconfigurations and area, sector, and position-level reconfigurations defined within an established facility configuration and within the areas of their supervision. This capability is defined and restricted by classmark in the configuration maps defined for supervisory positions. The reconfiguration options shall be displayed to the supervisory position, and the capability shall be provided for selection of the desired reconfiguration.

3.5.4.1.2.4 Reconfiguration Initiated by Maintenance and NAS Manager Positions - The maintenance and NAS Manager positions shall be provided the capability to initiate the reconfiguration of trunk circuits and position-level reconfiguration, as classmarked. The available options shall be displayed to the maintenance and NAS Manager positions. The capability shall be provided for selection of the desired reconfiguration.

3.5.4.1.2.5 Priority of Reconfiguration Commands - A facility-level reconfiguration command shall have priority over any lower level area, sector or position-level reconfiguration command. Area, sector, and position-level reconfigurations shall be provided within an established facility configuration. The priority in processing reconfiguration commands shall be for commands initiated by the area manager, by supervisory positions, and then by the maintenance and NAS Manager positions. A reconfiguration in progress shall not be interrupted by a subsequent reconfiguration command.

3.5.4.1.2.6 Initiation Commands - The VSCS shall receive commands directly from the area manager, authorized area supervisory positions, and the maintenance and NAS Manager positions. Reconfiguration initiation command inputs shall include at least the identification of the logical map to be implemented.

3.5.4.1.4 Monitor and Control - Upon receiving a reconfiguration initiation command, the reconfiguration operational sequence shall be controlled and monitored. The control function shall accept status and acknowledgments from the display and switching functions as to the progress of their respective reconfigurations. The display and switching functions shall acknowledge reconfiguration initiation. Immediately following initiation of the reconfiguration download stage, the VSCS shall determine the functional status of VCEs involved in the reconfiguration. If the functional status of any affected VCE(s) is "failed", the reconfiguration download shall be halted and status feedback shall be provided to the initiator. The initiator shall be given the option to continue or cancel the reconfiguration download. Immediately following the initiation of the reconfiguration execution stage, but prior to implementation of the new configuration maps, VSCS shall verify that both system level and VCE resources to complete the reconfiguration are available and shall reserve resources to complete the reconfiguration and/or to permit cancellation of the reconfiguration (i.e., return to the previous operational configuration as defined in 3.5.4.1.6.2). If resources (e.g. system-level or VCE) are not available, the execution stage shall be automatically halted prior to the implementation of the new configuration maps, and the initiating position shall be provided an audible alert and description of the cause of the halted reconfiguration. In the event reconfiguration execution halts due to insufficient system-level resources, subsequent requests by the initiator to continue the reconfiguration execution shall be denied unless sufficient system-level resources have become available and can be reserved. In the event reconfiguration execution halts due to VCE outages, the initiating position shall be provided the option to continue the reconfiguration. Execution shall be in accordance with 3.2.2.4, Reconfiguration timing requirements, or shall follow completion of any calls in progress, at which time completion status shall be provided.

The initiation and completion of each stage of the two-step reconfiguration process shall be reported to the initiator of the reconfiguration and to supervisors of areas affected by the reconfiguration. The completion of the preparation (i.e., download stage) of a two-step reconfiguration process shall also be audibly reported, however only to the initiator. The capability shall be provided to the initiator and to the affected area supervisors to request a report of the current status of each reconfiguration in progress. This status shall include, as applicable, at least the following:

a. Reconfiguration initiated.
b. Sector positions or trunks being reconfigured.
c. Completion pending release of calls in progress.
d. Reconfiguration completed.
e. Fault or failure reports.
f. Resource violations: i.e., A/G connectivity (Table XI) or A/G fan-out (Table XII).

The capability shall be provided to the initiator of the reconfiguration and to the supervisor(s) for reconfiguration within the area of their responsibility to initiate recovery procedures as defined in 3.5.4.1.6.2.

3.5.4.1.5.2 Database Size - The configuration database shall be capable of containing all position, sector, area, and facility maps necessary to support the operational requirements for routine and emergency reconfigurations within a facility. The capability shall be provided to define, at a minimum, 15 position maps per position in the configuration database. The capability shall be provided for the configuration database to contain at least the following: 15 sector maps per airspace sector, 150 area maps per area, and 25 facility maps per facility. Storage shall be sufficient to maintain the configuration database, backups of the configuration database, and maps and databases under development in support of resectorization.

3.5.4.1.5.5 Map Validation - Maps shall be validated off-line to ensure that under each configuration the connectivities for each position are achievable. Validation procedures shall also be provided for maps already included in a database. The system shall disallow downloading a database to the on-line system which, if the database were implemented, would result in the loss of communications at one or more positions.

3.5.4.1.6.1 Automatic Recovery - Recovery from a failure of an element used by the reconfiguration process shall be automatic when a redundant element is available. The reconfiguration process shall be automatically retried two times from the last logical step successfully completed, and shall then be flagged for manual recovery.

3.5.4.1.6.2 Manual Recovery - The capability to employ manual recovery methods shall be provided to recover from any failure of the reconfiguration process. Recovery shall automatically reestablish the previous operational configuration. Manual recovery capabilities shall include, at least, the following:

a. Canceling a reconfiguration request prior to completion.
b. Retry of a canceled reconfiguration after failure correction.

3.5.4.2.2.2 Other Communications Traffic Data Collection - Other communications support functions shall be available for traffic data collection. These functions shall include, at a minimum, all selections of system state changes (e.g., M/S for transmitters/receivers, activation/deactivation of BUEC for a frequency), selections of local position changes (e.g., auto transfer, split functionality, voice page on/off, radio transfer enable/disable), reconfiguration selections (e.g., maps in use, temporary modifications, reconfiguration processing times), activation of special call features such as IA OVR, CA queue call selection, and the activation of special call functions such as monitoring, and call forwarding.

3.5.4.3 System Startup

3.5.4.3.1 Installation Start - The VSCS shall have the capability of performing an installation start, as described in this paragraph, when it is installed for the first time. The control function shall manage the orderly startup of the VSCS. Diagnostics shall be requested from all functional areas on system startup and reported as required. The facility configuration map identified during startup procedures shall be implemented. The configuration data base and operational programs shall be downloaded. The design goal for a VSCS startup, including power up and configuration of positions, shall be no more than 30 minutes.

3.5.4.3.3 Warm Start - Warm start of the VSCS shall be provided. The current configuration of the operational system shall be recorded and that record updated. In the event of hardware or software failure, the operational program shall be restarted without reloading the configuration database, or losing the current selections at any operational position.

3.5.4.5.2 Functional Description - Use of support processors shall not require knowledge of the internal retrieval and storage mechanisms and other technical aspects of the system. Display formats shall be designed to provide optimum transfer of information to the user, and data shall be presented to the operator in a readily usable and readable format. Support processors shall be provided to support at least the following functional requirements:

a. Reconfiguration database management.
b. Traffic data reduction and analysis.
c. RTQC data formatting and reporting.
d. VSCS operational program startup.
e. Changes to operating system and software.

3.5.5 Position Split Functionality Mode Routing and Control

The position split functionality mode routing and control function shall be a position function which separates A/G voice and control from the G/G voice and control at the VCE. The position split functionality mode function shall divide all position communications into two distinct accesses to A/G or G/G communications via one dual jack module dedicated to A/G communications, and the other dual jack module dedicated to G/G communications.

The position split functionality mode routing and control function shall provide the capability for position split functionality mode as described in 3.3.3.9, and is not intended to impact VSCS switching and control functions. The control mechanisms required to establish, control, monitor, and disconnect split functionality mode shall be provided. Special features as specified in 3.3.3.9, shall include the following at a minimum:

a. A/G position relief briefing
b. G/G position relief briefing
c. A/G monitoring

3.5.5.1 Position Split Functionality Mode Routing and Control Functional Requirements

3.5.5.1.1 A/G Communications

3.5.5.1.1.1 VSCS A/G Special Features - While in split functionality mode, access to and processing of the VSCS A/G special features as described in 3.5.2.1.1, shall be restricted by position split functionality mode routing and control function, to the dedicated A/G dual jack module.

3.5.5.1.2 G/G Communications

3.5.5.1.2.1 VSCS G/G Call Processing and Features - While in position split functionality mode, G/G call processing and access to the VSCS G/G features as described in 3.5.2.2.1 and 3.5.2.2.2, shall be restricted by position split functionality mode routing and control function to the dedicated G/G dual jack module. The split functionality mode routing and control function shall require an additional legal recorder channel as described in 3.5.2.2.2.10.3, and shall restrict the communications that the monitoring position receives and that the OVR calling party receives as follows:

a. When the monitored position is operating in position split functionality mode, VSCS shall provide the capability to monitor all A/G voice communications, directed to and emanating from the headset plugged into the A/G dual jack module at the monitored position. The operational position monitoring a position operating in position split functionality mode, shall receive no indication that the monitored position is in position split functionality mode.

b. When the overridden position is operating in position split functionality mode, the OVR calling party shall receive the following A/G and G/G communications:

1. All G/G communications emanating from or directed to the over-ridden position's G/G dual jack module that are routed to the HS plugged into the G/G dual jack module.

2. When A/G monitoring is active (enabled but not suspended), all A/G communications emanating from or directed to the overridden position's A/G dual jack module that are routed to the HS plugged into the G/G dual jack module.

3.5.5.2 Position Split Functionality Mode Routing and Control Operational Feedback Requirements - VSCS shall provide the capability to route error, system, and warning messages, and tones as follows:

a. A/G messages shall be displayed on A/G screens
b. G/G messages shall be displayed on G/G screens
c. System messages shall be displayed on all screens
d. A/G tones shall be routed to A/G headsets/handsets
e. G/G tones shall be routed to G/G headsets/handsets
f. System tones shall be routed to all headsets/handsets

3.6.5 VSCS-TSU Interface

This interface shall provide a path between the VSCS and the Traffic Simulation Unit (TSU). The interface between the VSCS and TSU shall be as defined in the JPL ICD JPL D-4561.

3.6.5.1 TSU-CTSU Interface - This interface shall provide a path between the Contractor Traffic Simulation Unit (CTSU) and the JPL TSU. The interface between the CTSU and TSU shall be as defined in the JPL ICD JPL D-4355.

3.6.10 VSCS-CTS

The VSCS needs timing information to synchronize its operations with those of the rest of the facility, and to time-stamp messages and records that the VSCS sends out. The External Time Source (XTS) shall use a Digital Clock unit to provide time signals for VSCS use. The interface between VSCS and XTS shall be as described in the CTS/User Systems IRD.

3.6.15 VSCS-Existing Radio Interfaces

The existing radio interfaces will provide interconnecting paths between the VSCS and the A/G radio transmitters and receivers. The interface between the VSCS and the existing radio interfaces shall be as described in the VSCS-Existing Radio Interfaces ICD.

3.7.3.1 Maintenance Concept - The maintenance concept for this program shall be consistent with the FAA maintenance program described in the VSCS Integrated Logistics Support Plan.

3.7.3.3 Mean Time to Repair (MTTR) - Equipment MTTR shall not exceed 30 minutes for corrective maintenance, subject to maintainability analyses and demonstration. The final allocated MTTR shall be determined for each self-contained functional unit in terms of bringing the system back to being fully functional with redundancy. The mean bench repair time (MBRT) for VSCS LRUs shall not exceed four (4) hours. Support equipment MTTR shall not exceed 60 minutes for corrective maintenance, subject to maintainability analysis and demonstration.

3.7.3.8 Diagnostic Requirements - The VSCS shall provide the capability for air-traffic-controller-initiated action to confirm operability of any position functions. This confirmation will be derived from the results of automatic diagnostics that run as background activity to verify function operability. These background diagnostics will verify functionality of on-line items and off-line "power-on" items. The air traffic controller shall be able to confirm operability of the position with three (3) seconds and confirm operability of any selected function within one (1) second after request.

The VSCS shall provide the capability to the maintenance and NAS manager positions for verifying the VSCS operability of any air traffic controller position functions, any sector suites, the total facility, any set of position functions and any set of sector suites. Each confirmation will be presented to the maintenance and NAS Manager positions within three (3) seconds after request.

3.8 VERIFICATION

3.8.1 Plan

The system, function, and equipment verification for the VSCS shall be in accordance with the Maintenance Plan.

3.8.1.1 Automatic Verification - Automatic verification routines shall be provided within the VSCS to verify lower level functionality. Initiation of all verification routines may be performed manually, and maintenance personnel may interrupt any automatic verification routines. Results from these routines shall be directed to the maintenance person via the VSCS maintenance and NAS Manager positions. All results presented to the maintenance person shall provide the complete basis necessary for verification of system functionality.

3.8.2.1 BIT/BITE Functions - Whichever form BIT/BITE takes, it shall function within the VSCS environment to: (a) permit detection and isolation of malfunctions down to the LRU, and (b) permit verification, from full system to the LRU level, that a VSCS functionality, which may contain a repaired or replaced LRU, is performing properly.

3.8.3 Applicability

Verification shall be required in the following cases:

a. Verification of proper functional operation upon completion of necessary repairs.
b. Verification of the readiness of equipment not in service to be activated by reconfiguration activities.
c. Daily verification of system performance.

3.8.4 Methodology

Verification in the VSCS environment is the use of BIT/BITE to determine the readiness of a VSCS functionality to perform its specified functions. All BIT/BITE will be transparent to operational use, except for controller-initiated functional path verifications. BIT/BITE shall have adequate capability to determine this readiness to a confidence of 99%.

This means that in 99 out of 100 attempts to determine readiness, it is expected that at least 99 will give affirmative results when this is the true state of the system. When a specific functionality, by virtue of its critical importance, requires a higher degree of confidence, added testing shall be used at any operational console on a non-interference basis. This testing shall be accomplished using portable and/or centralized test diagnostics and shall be applied, as follows:

a. Digital signal paths shall be verified by inserting appropriately structured bit streams of test words and comparing the outputs with expected values.

b. Pulse-coded signal paths shall be verified by inserting appropriate analog signals, covering the frequency range of the path being tested, in a position ahead of the pulse-code circuitry, and comparing coded outputs with expected values. The analog signals shall have at least the highest and the lowest frequencies to be passed included in seven frequency intervals represented in the test signals. The distortion shall be tested by using filters to separate fundamentals and using the residuals as a test value.

c. Analog signal paths shall be verified by inserting appropriate analog signals, covering the frequency range of the circuit, and comparing outputs to expected values. The analog signals shall have at least the highest and the lowest frequencies to be passed represented in the test signals. This shall help to verify that the frequency response requirements for frequencies between 300 Hz and 3000 Hz are in accordance with 3.2.2.6.6. The distortion shall be tested by using filters to separate fundamentals and using the residuals as a test value.

3.9.4.1.1 Equipment Room Floor Space - The equipment room floor space required for a maximum sized VSCS, in accordance with sizing data, shall be within an area of 34 ft. by 56 ft. This area has four columns located 21 ft. on center. There will also be an adjoining area of 10 ft. by 18 ft.

3.9.4.5.1 Distribution Frame Cabling - The VSCS shall provide all cables, cross-connects, and any additional cable trays needed between the following entities: VSCS back room equipment and VCE; VSCS and the Contractor-provided IDF; Contractor-provided IDF and the FAA-provided VDF/RI IDF; Contractor-provided IDF and the FAA-provided MDS; Contractor-provided IDF and the transition switch. All cabling installations shall comply with FAA Order 6650.9 except the power/signal cable spacing specified by Paragraph 9b shall be applicable where facility space permits.

3.9.4.9 Intraconnection and Interconnection Cables - The VSCS shall provide all intraconnection and interconnection cables and connectors required for factory testing, equipment site installation, checkout, acceptance testing, cutover, operation, and maintenance of the VSCS, for all VSCS installations, designed for Government-furnished underfloor and overhead distribution and cabling facilities. All Cabling installations shall comply with FAA Order 6650.9 with exception of the power/signal separation required by Paragraph 9b in those areas where facility space is insufficient to allow specified separation. VSCS cables shall connect electronic devices and modules associated with any transmission path located in consoles and the equipment room. All such cabling shall permit accessibility to equipment for test maintenance and replacement. After installation, all cabling shall meet grounding requirements and electromagnetic compatibility (EMC) conducted and radiated electromagnetic interference (EMI) requirements. Cabling and wiring shall comply with 3.5.5.25 of FAA-G-2100; National Electric Code, NFPA-70, 1990 and FAA-C-1217.

3.9.4.10.2 Overheat Warning - A warning device shall be provided in each separate cabinet to indicate when the temperature exceeds the maximum safe operating temperature for the equipment within the cabinet. A warning indicator readily visible from the cabinet exterior shall be provided on the cabinet. The overheat warning shall also be reported and displayed at the maintenance and NAS Manager positions. Overheat warning requires maintenance personnel action to determine the cause of warning and take corrective action.

3.9.7.1 VSCS Switching Equipment - The VSCS switching equipment, including the A/G backup switch and control, shall operate from:

a. Voltages: 120 V ± 10%, single phase; or 208 V ± 10%, single phase
b. Frequency: 60 Hz ± 2.0%.

The power function within the VSCS switching equipment shall meet the load balance specified in 3.3.2.3.1 of FAA-G-2100. The power function within the VSCS switching equipment shall meet the power factor specified in section 3.3.2.6 of NAS-IR-80104201.

3.9.7.2 VSCS Console Equipment (VCE) - The VCE shall operate from the FAA PCS as follows:

a. Voltage: 208 VAC ± 10%, single phase, two wire
b. Frequency: 60 Hz ± 2.0%.

The power source is a critical resource, and the VSCS design must be such as to minimize energy consumption; the VSCS design shall limit power consumption of the common console position equipment to 510 watts per console.

The power function within the VCE shall independently meet the power factor specified in Section 3.3.2.6 of NAS-IR-80104201.

3.9.7.4 VSCS Power Failure - The design of the VSCS shall be such that full operational functionality shall be maintained by all VSCS subsystems in the event of failure of any one of the AC power buses.

3.9.8 Power Distribution

The AC power shall be distributed to the VSCS in a dual critical AC busing arrangement. The power supplied to the VSCS switching equipment will be uninterruptible, 120 VAC, single-phase, or 208 VAC, three-phase and will be regulated by the VSCS internal power supplies. The power supplied to the VSCS console equipment will be uninterruptible 208 VAC, single phase, and will be regulated by the VSCS internal power supplies. The busing arrangement shall provide dual AC/DC power distribution to all VSCS equipment. The power shall be routed through two independent power paths physically separated to approach the equipment from opposite directions, (temporary installations, i.e., M-1 VEMs, Ancillary Positions, and DYSIMs, are not required to have the separated paths approach the equipment from opposite directions) such that a failure or obstruction of one AC/DC power bus will not disrupt AC/DC power on the other bus. Power distribution design and implementation shall be in accordance with National Electrical Code, NFPA-70, and FAA-C-1217.

3.9.10 Startup Surges - The peak inrush current during startup shall not exceed three times the normal peak operating current. The duration of the inrush operating current shall not exceed 350 milliseconds. The duration is defined as the time from input power application to the time at which the power returns to its steady state.

3.9.11 Power Supplies - Each power supply shall have front panel test points for measuring voltage outputs. Each power supply shall have a front-panel AC circuit breaker that can also be used as an ON-OFF switch during maintenance activities. The VCE ON-OFF switch should be located out of the controller's normal range of motion to prevent accidental activation. Each power supply shall contain electronic circuitry to prevent damage caused by external short circuits. The power supply shall recover immediately upon the removal of external short circuits. The electronic short circuit protection circuit shall allow removal or addition of electronic modules of capacitive loads to be switched ON without causing any circuit protection devices to operate or induce any other side effects. Each power supply shall include circuitry to activate a remote alarm at the maintenance and NAS Manager positions. Power supplies shall allow power-on installation or removal of VSCS plug-in assemblies without degradation to the VSCS or any VSCS assembly.

3.9.15 Position Equipment Divided Power Connections - Power connections to VSCS display panels and console equipment shall be wired from two opposing directions from outside the console. Power distribution within the room shall be physically separated to approach the equipment from opposite sides and shall originate from separate dual source AC power system branch circuits (see 3.9.11). The requirement to approach the equipment from opposite directions is not imposed on temporarily installed equipment such as M-1 VEMs, Ancillary Positions, and DYSIM positions.

3.10.1.1.1.2 File Management Facility - The system shall provide mechanisms for locating files and for accessing, locking, and updating file information at the record level. The file management facility is required in such functions as traffic data reduction, described in 3.5, Switching and Control Functions.

3.10.1.1.2.2 Mathematical Libraries - Mathematical libraries shall include procedures to perform standard mathematical tasks that are required by VSCS functions, such as RTQC and statistical data analysis.

3.10.1.3 Support Software - Support software shall be called upon when the system requires a special report and when priorities and available system resources permit. The special support includes hardware diagnostics, test, simulation, RTQC, traffic data analysis, and reconfiguration support.

3.12.2 Transition Equipment

A transition switch shall provide switchover between the VSCS and the existing communications equipment to access the G/G IP/PABX trunks, and the A/G radio audio and control (Radio Control Equipment (RCE), BUEC, and existing radio interfaces). The switchover shall be on a line-by-line basis for testing and as a whole for transferring ATC communications operations. Special interface equipment shall be provided as necessary to ensure continuing operation of the existing communications equipment as interim provisional backup for VSCS operations. The transition switch shall provide for complete access to the existing communications equipment or the VSCS and its interfacing equipment (s), as selected by ATC operations personnel.

Transition Switching of all paths of either the VSCS or existing communication system shall be manually initiated from a single remote control point which shall be capable of being located up to 1000 feet from the transition switch equipment. The transition switch shall also have a local point of control at the switch. The designation of the point of control (local or remote) shall be under key security.

Switchover between the VSCS and existing communication system shall be completed within one (1) second. Visual indication of whether the switchover was successful or unsuccessful shall be provided at the local and remote control point.

3.13 TRAINING AND DEPOT SUPPORT REQUIREMENTS

The VSCS Training and Depot Support requirements are described in Appendix D: Training and Depot Support Requirements.

10.2 DEFINITION AND TERMS

Action, Continuous Touch - A manual operation at the VSCS human/system interface which initializes and uses certain communication circuits and VSCS controls that are activated for the duration of the continuous touch action, and deactivated with the cessation of the continuous touch action.

Action, Single Touch - An operation that occurs at the VSCS human/system interface which affects communication circuits and VSCS controls in one of two ways: (1) momentary-to-make (latch or enable), and (2) momentary-to-break (unlatch or disable).

Active Call or Position Active Call - A call (placed or received) under the control of position operator, and to which they are conversant.

Active Position - An operable controller position functioning with respect to a configuration map.

Active Sector - A sector in which air traffic control is provided in one or more assigned fix posting areas.

Address:

a. A character or group of characters that identifies a register, a specific part of storage, or some other data source or destination,

b. To refer to a device or an item of data by its address.

Advanced Automation System (AAS) - A system of four computer complexes that support air traffic control. The four computer complexes are:

a. Area Control Computer Complex (ACCC) at ARTCC and ACF,
b. Tower Control Computer Complex (TCCC) at Air Traffic Control Tower (ATCT),
c. System Support Computer Complex (SSCC) at FAATC,
d. Research and Development Computer Complex (RDCC) at FAATC.

Air Traffic Control Position - A common console configured primarily for en route, en route support or terminal air traffic control activities.

Air Traffic Controller - A person authorized to provide air traffic service including en route and terminal approach control.

Ancillary Position - A common console configured primarily for non-air traffic control activities.

Area Control Computer Complex (ACCC) - That computer complex (hardware and software) of the AAS which provides continuous real-time support of air traffic control of an area assigned to an ACF.

Area Control Facility - A building at which en route and terminal air traffic control is provided and supported by an ACCC.

Area-Level Reconfiguration - Reconfiguration affecting an area's communications and functional capabilities.

Area Map - A correspondence set wherein the communications assignments and control capabilities of an area (predetermined sets of sector suites) within a facility are defined. A correspondence set between the physical maps and configuration maps of grouped sector suites (see Switch Map).

Assembly - A number of parts or subassemblies or any combination thereof joined together to perform a specific function and capable of disassembly.

Assign - A VSCS configuration action that provides specific A/G, G/G communication connectivity capabilities and other communication feature capabilities to air traffic control and ancillary positions.

Assigned Frequency - A frequency in an air traffic control position map made available for use at a position. Frequency assignment implies only the availability of the transmitter and receiver to the position.

Background Mode - In a multi-program system, the condition under which low-priority programs are executed. The execution of data processing operations that are secondary to real-time voice switching and control.

Background Noise - Noise level present on a connected voice circuit.

Backup - Provision for an alternate means of operation in case the primary means is not available.

Back up - The act or process of making a backup.

BUEC (Backup Emergency Communications) - A secondary backup A/G communications network that is independent of primary A/G communications transmission paths and equipment. BUEC is not the same as the backup A/G switch.

Busy - A condition that exists when a called position has an active call in progress and a full CA queue. A call processing tone that is generated when the above condition exists at a called position (G/G only).

Call - A demand to set up a communication connection.

Call Features - Call forwarding, call monitoring, supervisory recording, headset or loudspeaker call routing, call queuing with caller identification, etc. Types of calls are made in certain modes with certain features invoked; for example, an interphone (type), indirect access (mode), override (feature) call that is monitored (feature) and recorded (feature) by the calling party's supervisor.

Call Forwarding - A switch-provided call feature that permits the user to instruct the switching equipment to redirect G/G calls destined for one position to an alternate position.

Call Modes - Direct access, indirect access, and voice call (G/G only).

Call Pickup - The capability for a position, other than the called position, to answer IP calls, from appropriate trunks. Answering the call terminates ringing at the called position.

Call Transfer - A switch-provided call feature that allows a user to redirect a G/G call that has either been answered or that is in the CA queue at a given position to another position.

Call Types - Intercom and interphone (G/G only).

Calling Line Identification or Caller ID - A switch-provided feature whereby a call source is automatically identified to the called position.

Catastrophic Failure - Failure that is both sudden and complete.

Channel - A communication path providing one-way or two-way transmission between two terminations.

Circuit - (1) A network providing one or more closed paths. (2) An interconnection of electrical/electronic elements. (3) A conductor or system of conductors through which an electrical current is intended to flow.

Classmark - An object program code that enables or disables access to VSCS services and functions. A service classmark enables or disables the class of service with respect to a trunk circuit, mainly its signaling as defined by an Interface Control Document (ICD). An operational classmark enables or disables position access to VSCS communication capabilities.

Commercial Standard - Standard established by a commercial organization or corporate entity governing design, development, documentation, control, manufacture, production, testing, etc., of its commercial and internal products.

Common Answer - A switching function whereby certain G/G calls incoming to a position are directed to a queue to be selectively answered by the position user (also known as automatic call parking).

Common Console - A standardized, human-engineered equipment cabinet including a work surface with provision for physical devices including: main display, interactive display, data entry keyboard, keypad, communications jacks, loudspeakers, and VSCS panel. Various configurations of physical devices provide for air traffic control and ancillary activities.

Complete Failure - Failure resulting from deviations in characteristics beyond specified limits such as to cause complete lack of the function.

Configuration - The arrangement of a computer system or network as defined by the nature, number, and the chief characteristics of its functional elements. The functional or physical characteristics (or both) of systems hardware/software.

Configuration Map - A correspondence set between VSCS hardware elements and software elements based on their chief functional and physical characteristics in an arrangement that provides communications assignments and capabilities through applications of operational and service classmarks (also see Program Control).

Connectivity - An established circuit.

Contrast Ratio - The ratio of the maximum to the minimum luminance values in a display device (color or monochrome).

Control Sector - An airspace area of defined horizontal and vertical dimensions for which a controller, or group of controllers, has air traffic control responsibility. Control sectors are established based on predominant traffic flows, altitude strata, and controller workload. Pilot-controller communications during operations within a control sector are normally maintained on discrete frequencies assigned to the control sector.

Controller - See Air Traffic Controller.

Controller Position - A common console configured for en route or terminal approach air traffic control activity.

Critical Failure - A failure that is likely to result in injury to persons and or significant damage to material.

Cross-Coupling - A switch-provided feature wherein the received voice on one frequency in a pair of frequencies is transmitted over the other frequency of that pair without operator intervention.

Crosstalk Index - The probability, expressed in percent, of a system user hearing one or more intelligible crosstalk words during a call. In the Bell System, for the Loop Plant, the recommended performance objective for network planning and equipment design is that a 0.1% crosstalk index not be exceeded for 99% of the loops in the plant.

Cutover - The final change of operation from the present ARTCC communication systems to the VSCS.

Database - A collection of data fundamental to the operation of a system or enterprise. Database usually connotes a systematized collection of data that can be immediately accessed and manipulated by a system for a specific purpose. Data Bank describes any collection of data that may or may not be interrelated or immediately accessible by a system.

Data Entry Device - Device located at the common console which is used to enter data into the ACCC or the VSCS.

dBm - A logarithmic measure of a power with respect to a reference power of milliwatt (one one-thousandth of a Watt).

$$dBm = (10) \log (P/0.001 \text{ Watt})$$

dBm0 - A logarithmic measure of power (in dBm) at the Zero Transmission Level Point (0TLP) to produce the same power in dBm at another point in the circuit using a 1.0 KHz tone.

dBmC0 - The test tone 1000 Hz power level measured at the 0TLP using a “C” message weighting network.

dBrn - A logarithmic measure of power with respect to a reference power of one picowatt (-90 dBm), used for noise tests.

$$0 \text{ dBm} = 90 \text{ dBrn or } dBrn = (10) \log (P/10^{-12} \text{ Watt})$$

dBrnC - A logarithmic measure of power relative to a noise reference of -90 dBm as measured with a noise meter weighted by a special frequency function called C-Message Weighting. The interfering effect of noise given in dB above a noise reference of -90 dBm at 1.0 KHz measured with a C-message filter.

dBrnC0 - Noise measured in dBrnC and referred to the 0TLP.

Decibel (dB) - A logarithmic measure of the ratio between two powers.

dB = (10) log (P2/P1)

Degradation Failure - Failure that is both gradual and partial.

Deselect - An action at an ATC or ancillary position touch entry device or interactive display that results in the deactivation of an A/G communication connectivity at that position.

Deselection - Causing the state of a selected feature of the VSCS to change to not selected.

Designator - A name, entitlement, or distinctive mark intended to point out, assign, indicate, or specify.

Direct Access - A call mode wherein the entire call processing sequence required to establish circuit connectivity is accomplished as the result of a single touch action (G/G only).

Disable - The deactivation of the communication connectivity between the VSCS and the radio interface as a result of a DESELECT (A/G only). The deactivation of any VSCS feature or control function.

Disabled Receiver - A receiver, either main or standby, for a selected frequency at an air traffic control position which the position operator has indicated will not be used for the reception of voice at the position. Disabling a receiver at a position does not affect its enabled or disabled status at any other operational position. Equivalent to locally muting the receiver.

Disabled Transmitter - A transmitter, either main or standby, for a selected frequency at an air traffic control position which the position operator has indicated will not be used for transmission of voice from the position. Disabling a transmitter at a position does not affect its enabled or disabled status at any other operational position.

Electronic Patch Panel - Provides a capability of remote access for the purpose of testing and monitoring individual or grouped VSCS voice paths.

E&M - A signaling method for transferring supervisory and control information over a trunk circuit using the signal circuits “E” and “M” leads. The “E” lead transmits into the trunk circuit and the “M” lead transmits into the signal circuit.

Emergency Frequency - See Guard Frequency.

Enable - The activation of the communication connectivity between the VSCS and the radio interface as a result of SELECT (A/G only). The activation of any VSCS feature or control function.

Enabled Receiver - A receiver, either main or standby, for a selected frequency at an air traffic control position which the position operator has indicated will be used for the reception of voice at the position. Enabling a receiver at a position does not affect its enabled or disabled status at any other operational position.

Enabled Transmitter - A transmitter, either main or standby, for a selected frequency at an air traffic control position which the position operator has indicated will be used for the transmission of voice from the position. Enabling a transmitter at a position does not affects its enabled or disabled status at any other position.

Erlang - A unit of telephone switch traffic intensity measured in number of arrivals per mean service time. For carried traffic measurements, the number of erlangs is the average number of simultaneous connections observed during a measurement period.

Facility Backup - The act or process of backing up a failed ACF by expanding the controlled sectors of adjacent ACFs to encompass the control sectors of the failed ACF with respect to navigation, surveillance, control and advisory voice and data communications necessary for continued safe air traffic control. Facility backup lies in the AAS/ACCC control domain.

Facility-Level Reconfiguration - A change of communication assignments and control capabilities wherein the modification or changeover occurs with respect to facility maps (also see Facility Backup and Reconfiguration).

Facility Map - A correspondence set wherein the communications assignments and functional capability of an entire facility are defined. A correspondence set between the physical maps and the configuration maps of all sector suites.

Fail Soft - If a failure occurs, that failure will not disrupt the entire system. There may be degradation of service, but basic service will continue.

Fail Soft/Fail Safe - A designed property of an item which prevents its failures being critical failures.

Federal Telecommunications System (FTS) - A leased communications service for use by the U.S. Government.

First Article System - A prototype system upgraded after production award.

First Production System - The initial production equipment.

Fix Posting Area - A volume of airspace, bounded by a series of connected line segments with altitudes, which is assigned to a sector.

Flashing - A visual signal interrupted 60 times per minute with a 50:50 on:off ratio.

Fluttering - A visual signal interrupted 720 times a minute with an 80:20 on:off ratio.

Foot Candle - The illumination on a surface one (1) foot square on which there is a uniformly distributed flux of one (1) lumen.

Foot Lambert - Photometric brightness equal to that of a perfectly diffusing surface emitting or reflecting light at the rate of one (1) lumen per square foot.

Frequency - A part of the radio spectrum used by the FAA to carry communications between controllers and pilots. The spectrum contains ultra-high (used for military air traffic) and very high frequencies (used for civilian traffic).

Frequency Allocation - Designated radio frequency bands for use by specific radio services. Air traffic control frequency allocations used by the FAA are:

118.000 MHz to 135.975 MHz for civilian aircraft
225.0 MHz to 399.95 MHz for military aircraft

Frequency Pair - A combination of VHF and UHF frequencies used as a single radio communication channel.

Full Image - Pertaining to a disk or tape; a faithful likeness of the subject matter on the original.

Functionality - The characteristic(s) of one or more equipments whose configuration provides the capability to perform specified activities.

Functional Path - The set of physical items/equipments necessary to initiate, sustain, and terminate operation of a given function (e.g., radio, IC, or IP).

Grade of Service - The proportion of total calls, usually during the peak busy hour, which cannot be completed immediately or served within a prescribed time.

Gradual Failure - Failure that could be anticipated by prior examination or monitoring.

Guard Frequency - A designated point in the radio spectrum to which radio equipment is kept tuned expressly to monitor for and to make emergency broadcasts. The FAA Radio service uses 121.50 MHz and 243.0 MHz as guard frequencies.

Handoff - Turning over air traffic control of an aircraft from a controller of one sector to another controller of an adjacent sector or terminal.

Handoff Function - Turning over control of an aircraft to another controller or facility.

HOLD - The capability of suspending a call in progress while placing or answering another call.

Human/System Interface - See Man/Machine Interface.

Idle Channel Noise - Noise level present on an unconnected voice circuit.

Indirect Access - A call mode wherein the call processing sequence required to establish a communication link or to select a control function is accomplished by entering multi-digit numbers on a remote keypad. The keypad is activated by selecting the IA mode.

Industry Standard - Standard established by authority of a professional, technical, or industrial organization (association, institute, society, etc.) such as ANSI, EIA, or IEEE.

In-Service Circuits - Those time-shared circuits of the system which achieve a desired grade of service. The failure of one or several will not make the system inoperative, but may degrade the service during peak load.

Intelligible Crosstalk - The speech signal transferred from one voice channel to another which is sufficiently understandable under pertinent circuit and room noise conditions that meaningful information can be obtained by the disturbed party.

Interactive Display Panel - A VSCS display panel that provides access to A/G and G/G communications.

Intercom - A type of call that provides stations (positions) intrafacility communications on a voice switch. Communications between controllers at the same facility.

Intermediate Distribution Frame - A distributing frame used to terminate in-house cabling.

Interphone - A type of call that provides VSCS positions interfacility communications. Communications between controllers at different facilities.

Latching - A function that either is or emulates a pushbutton that locks in the down position upon a first touch, and requires a second touch to release the locked condition. The desired activation is in effect for the time the button is in the locked position.

Line - A family of equipment and devices designed to provide users with access to a choice of communication services and features. A physical channel between the VSCS position equipment and G/G and the VSCS main frame.

Line Circuit - The circuitry required to terminate, convert, and provide transmission, supervisory and control signals at the position side of the interconnection networks, and at the position and/or equipment end instruments. This circuitry can be divided between actual network terminations and position equipment terminations. This includes all circuitry that interfaces the position with the interconnection networks and the common control.

Line Replaceable Unit (LRU) - Any system item that is replaceable at the organizational maintenance level without using any special tools.

Local Muting - The muting by VSCS of voice received from the radio interface at the operational position activating the muting function for selected frequencies.

Lockout - The inability of one or more users to initiate voice transmission on a given circuit because that circuit is already enabled or in use (see Push-to-Talk).

Logical Console Identifier - An alphanumeric string of up to 8 characters which is used within the VSCS configuration maps to represent an unspecified physical console, that is, a physical console whose physical console identifier has not yet been designated. A console's logical console identifier, in conjunction with the VSCS Physical Console Assignment Mapping, permits the physical location of that console to be uniquely determined.

Logical Map - Map that defines position identification for communications connectivity independent of the position's physical address.

Loop-Back Testing - A standard telephone test procedure involving accessing the circuit at any test access point and sending test signals down the line. The test signals are returned (looped back) to the test access point where diagnostics are then performed on the returned test signals. The loop-back points are located progressively further away from the test access point until either the fault has been detected or the entire circuit has been tested.

Main Distribution Frame - A distributing frame used to terminate leased and Government-owned long-line facilities on the one side and cable pairs for line and trunk equipment terminals associated with a switching system on the other side. The main distribution frame is the interface point used for associating any outside line or trunk with any desired equipment terminal or with any other outside line or trunk. It usually serves as a test point between in-house and outside plant cabling.

Main (or Standby Units) - Units that are operationally critical and are redundantly integrated into the system to achieve a high degree of reliability.

Maintenance Position - The VSCS maintenance workstation (also see Ancillary Position).

MALF - Malfunction signal from BUEC.

Man/Machine Interface - (Pertaining to station control and data acquisition). The operator contact with equipment governed by ANSI IEEE C37. MIL-STD-1472 is recommended as a reference for use in the design and evaluation of the man/machine interface.

Manual Ring - A selective signaling arrangement that consists of a manual ring, generated by the calling party, to alert a specific station on a multidrop circuit in which all stations receive the ringing signal.

Map - To establish a correspondence between the elements of one set and the elements of another set. A correspondence set between elements of one set and elements of another.

Mean Talker Level - Specified at -13.9 dBm0, which is 0.9 dBm less than the maximum voice frequency (VF) signal (average more than 3 seconds) on a standard VF channel and 2.1 dBm more than the VF channel interface standard.

Meet-Me Conference - A conference call in which parties desiring to enter a (pre-arranged) conference call do so by individually accessing the conference feature (e.g., a conference bridge).

Mode - A possible, customary, or preferred way of doing something.

Modular - The extent to which hardware/software is composed of discrete components such that a change to one component has minimal impact on other components.

Module - A limited aggregate of LRUs, data, and contiguous codes that performs independent functions. Typically, modules are used repeatedly in the construction of the system.

Monitor - To listen in on the communications of another controller.

Multiple - Providing more than one connection at a common point.

Multi-point Trunk - A dedicated trunk shared by three or more positions at two or more facilities.

Multi-position Sector - A sector whose control involves the use of more than one common console; typically, it will use two or three adjacent consoles.

Muting - The capability to eliminate receiver output volume on selected air/ground channels.

Muting, Local - See Local Muting

Muting, Remote - See Remote Muting

Nonlatching - A feature which either is or emulates a pushbutton that requires an operator to provide continuous touch action to maintain the desired pushbutton activation. The activation is terminated by the release of touch action on the pushbutton.

Off-Hook - One of several line/trunk supervisory signals. Normally a line/trunk state change of idle-to-off indicates a request for service.

Off-Line - (1) An operating condition wherein human action is required between the original recording functions (data recording and storage) and the ultimate data processing functions, including conversion operations, and loading/unloading operations incident to the use of point-to-point or data gathering systems. (2) The operations of a functional unit that are not under the continuous or automatic control of a central or main processing unit.

On-Line - (1) An operating condition wherein input data enters the system directly from the point of origin or in which output data is transmitted directly to where it is used. (2) The operations of a functional unit that are under continuous control of a central or main processing unit.

Operational Configuration - Hardware, communications, functional assignments, and connectivity currently in effect in VSCS.

Operating Position - A manned active position.

Operational Position - A position defined within a configuration.

Outlier - Data point which is not typical of the rest of the data; it may lie three or four standard deviations or further from the mean of the sample.

Outpulsing - Pulsing from a sender.

Override (OVR) - A switch provided call feature whereby a call being placed results in connection to the called party, even if the called position has an active call in progress.

PABX (Private Automatic Branch Exchange) - A private automatic telephone switching system that provides for transmission of calls to and from the public switch telephone network, and private switched or dedicated telephone networks.

Partial Failure - Failure resulting from deviation in characteristics beyond specified limits, but not such as to cause complete lack of the required function.

Physical Console - A specific physical device and/or workstation which includes a set of VSCS console equipment. Examples include an M-1 console, a common console, and the VSCS supervisory workstation. Each physical console has a unique physical console identifier.

Physical Console Assignment Mapping - A correspondence of logical console identifiers to physical console identifiers. The correspondence is such that only one physical console identifier is associated with a logical console identifier.

Physical Console Identifier - A site adaptable alphanumeric string of up to 4 characters which uniquely identifies a specific physical console. Each physical console has a unique console identifier. From its physical console identifier, the precise location of a physical console can be determined.

Physical Map - A correspondence set of the functional and physical characteristics of VSCS hardware.

Position - A location or piece of equipment at which a person works, e.g., that portion of a sector suite that is normally provided for the use of one ATC person. An M-1 or a common console configured for an air traffic control or ancillary activity.

Position Equipment - The position equipment consists of all VSCS equipment mounted in the console as well as the associated position logic, including its power supply (also see Common Console).

Position-Level Reconfiguration - A change of assignments and control capabilities wherein the modification or changeover occurs with respect to position maps.

Position Map - A correspondence set wherein the communications assignments and functional capabilities of a single position are defined. A correspondence set between the physical map and a configuration map for a single position (also see Switch Map).

Position Roll-In - Combining of communications assignments and functional capabilities required to control a sector at one or more positions of a sector suite.

Position Roll-Out - Distributing communications assignments and functional capabilities required to control a sector among positions of a sector suite.

Position Split Functionality Mode - A mode of operation at a position in which voice communications are divided such that one DJM is dedicated to A/G communications, and the other DJM is dedicated to G/G communications.

Preempt - (1) The disconnection and subsequent reuse of part or all of an established connection of lower priority origins by a higher priority source. (2) Jack module preemption is disconnection and subsequent reuse of all the pre-established connections at a position. (3) PTT preemption by frequency classmark is disconnection and subsequent reuse of part of the established connection(s) for use of the frequency.

Preemption Capability - Ability to take over all existing communications channels.

Preset Conference - Same as progressive conference except that conferees will be called automatically by the system when the conference call is requested.

Program Control - The interaction between the software and the hardware of the switching system which determines the time and sequence in which processing occurs. The relationship between a set of instructions and the electronics incorporated into the design of the switching system which enables that system to recognize and perform tasks by interactive user commands or without further intervention by a system user.

Progressive Conference - A conference call in which conferees are successively added to the conference, up to the conference limit, at the discretion of a calling party.

Prototype System - A pre-production model.

PTT Lockout - Condition arising when an attempt is made to transmit on a frequency that is already being used. Transmission will not be permitted to the attempting position unless PTT preemption has been for that frequency.

PTT Preemption - A classmarked capability for a frequency at a position whereby PTT activation from that position will cause seizing of the frequency, locking out all other attempted users including the user just previous to PTT (preemption) activation.

Pulsing - The signaling over the communication path of signals representing one or more address digits required to set up a call.

Pushbutton Action or Pushbutton Operation - The selection of an operation, function, or process by pressing or touching a function key or some display group representing a function key. Pushbutton operation, although in existing equipment refers to the operation of a mechanical switch, has a broader meaning to include such state-of-the-art controls as touch membrane, capacitance touch, touch-entry standards and to meet the reliability/maintainability requirements of this document.

Push-to-Talk (PTT) - A method of communication over a speech channel in which transmission occurs in only one direction at a time; while talking the talker is required to keep a switch activated (continuous touch action).

Radio Transfer (R/T) Switch - The R/T Switch (when enabled) will route all incoming A/G voice to the loudspeaker and suspend current voice monitors regardless of frequency voice routing settings and automatic voice routing.

Real Time Quality Control (RTQC) - Real time quality control is the on-line capability of fault detection, isolation, and reporting in real time.

Receiver - Equipment that picks up radio signals sent by transmitters.

Reconfiguration - A change of communication assignments and control capabilities through the modification of the invoked configuration map or through a changeover from one map to another. Reconfiguration can take place at the position, sector, area, and facility levels.

Remote Override - The capability to provide override between two independent systems, VSCS to/from TCS.

Remote Muting - Muting of receivers for selected frequencies. The VSCS will not receive voice from the radio interfaces for frequencies on which the remote muting function has been activated.

Resectorization - Redefining and restructuring sectors and the creation of new sectors to support the establishment of new airways and changing traffic patterns.

Return Loss - The return loss at an impedance discontinuity on a two-wire line is the ratio, expressed in decibels, of the level of incident signal to that of its reflected signal. The return loss on a four-wire line is the insertion loss measured between transit and receive pairs with the far end terminated as specified. Echo return loss is a weighted average (on a power basis) of the return loss at all frequencies in the range 500 to 2500 Hz. Single-frequency return loss is the lowest non-weighted return loss in the 0.2 to 3.2 KHz band.

Ringback - A tone that indicates to a caller that a ringing signal is being applied to a called station.

Sector - A volume of airspace, bounded by a series of connected line segments with altitudes defined for the purpose of assigning responsibility for control of aircraft in the airspace (also see Control Sector).

Sector Airspace - One or more contiguous fix posting areas (FPAs) controlled from a single control sector (i.e., the FPAs assigned to a control sector). The sector airspace may overlie or underlie airspace controlled by another sector.

Sector Area - See Sector Airspace.

Sector Combining - Combining of more than one sector's communications assignments and functional capabilities at one or more sector suites.

Sector Decombining - Distributing of combined sector communications assignments and functional capabilities among sector suites.

Sector-Level Reconfiguration - A change of ATC communications assignments and control capabilities wherein the modification or changeover occurs with respect to sector maps.

Sector Map - A correspondence set wherein the communications assignments and functional capabilities of all positions in a sector suite are defined. A correspondence set between the physical maps and the configuration maps of all positions in a sector suite (also see Switch Map).

Sector Suite - A collocated set of one to four common consoles equipped with appropriate sets of data entry and display devices. The set is assigned to one or more controllers working a control sector.

Sector Suite Common Console - Physically identical position workstations within a sector suite which contain the VSCS common console equipment as a primary component.

Select - An action at an ATC or ancillary position touch entry device or interactive display which results in the activation of an A/G communication connectivity at that position.

Selected Frequency - One of an air traffic controller's assigned frequencies which the position operator has indicated will be included in the set of currently operational frequencies to be used for transmission and reception at the position. Connectivity of the transmitter and receiver has been confirmed.

Selective Mode Operation - In this mode, a VHF and UHF assigned to a sector are combined into one trunk. The controller may select VHF only, UHF only, or select both frequencies simultaneously. Using this system, a controller keying one frequency (VHF or UHF) denies the other frequency (UHF or VHF, respectively) to another controller.

Selective Mode Transmitter Tracking - A classmark assigned to selective (paired) radios which, when enabled, will cause the enabling of both transmitters of the pair when either transmitter is enabled.

Sender - Equipment that generates and transmits signals in response to information received from another part of the system.

Service Circuits - Those time-shared circuits of the system which achieve a desired grade of service. The failure of one or several will not make the system inoperative, but may degrade the service during peak load.

Service F - A communications service comprised of dedicated circuits leased by the FAA.

Sidetone - The acoustic signal resulting from a portion of the transmitted signal being coupled to the receiver.

Single Point Failure - A failure of a single item which has the effect of failing an entire function or functionality.

Signaling - With respect to telephone switching systems; the transmission of address and other switching information between stations and central offices, stations and switching entities, and between switching entities.

Site - Any location where equipment is to be supplied or installed.

Sound Pressure Level (SPL) - An acoustical intensity expressed in decibels above a reference level of 0.0002 dynes/square cm.

Split Mode Operation - The VHF and UHF frequencies of the sector are carried on two different trunks. Thus, there is no contention; PTT lockout affects only the selected frequency.

Standard - Regularly and widely used, available, or supplied; definite rule for measurement of quantity, weight, extent, value, or quality as established by authority.

Subassembly - Two or more parts that form a portion of an assembly or a unit replaceable as a whole, but having part or parts that are individually replaceable.

Subsystem - A combination of sets, groups, etc., that performs an operational function within a system and is a major subdivision of the system.

Sudden Failure - Failure that could not be anticipated by prior examination or monitoring.

Supervisory Position - The workstation for first line supervisor who is typically responsible for less than eight sector suites (also see Ancillary Position).

Support Position - The workstation for personnel supporting air traffic control (also see Ancillary Position).

Switch Map - That portion of a position, sector, area, and facility map that provides the correspondence between the logical connectivities and the physical connectivities within a configuration.

System - The equipment, hardware/software or subsets of two that fulfill the functional requirements of this document.

Support Functions - All functions not listed in Table IX, 3.2.3.1, are support functions for availability considerations.

System-Generated A/G PTT - An A/G PTT signal initiated by the system to support cross-coupling, weather broadcast, and emergency frequency broadcast.

Tactical Special Use Frequency - Each area is assigned one UHF frequency allowing military planes (typically high-performance planes) to change their communication frequency only upon entering a new area as opposed to a new sector.

Telephone Position Circuit - All circuitry required to permit the telephone instrument or headset to access all voice transmission paths terminating at the position**.**

Transmission Level Point - A signal-measuring point, defined during the transmission system design, where a signal level is specified in relative, but not absolute, terms. 0TLP refers to the zero transmission level point which, in contemporary design practices, is an arbitrary reference along a transmission path. The transmission level at any other point is the nominal design gain (or loss) in decibels relative to zero transmission level at 1.0 KHz. The VSCS 0TLP will be defined by the contractor; the zero transmission level is specified as 0 dBm at 1.0 KHz.

Transmitter - Equipment that sends radio signals to the outside world; these signals are picked up by receivers.

Trunk - A communication channel between two switching systems. A two-wire or four-wire circuit that can be a leased or a Government-owned transmission facility connecting the VSCS with external or remote equipment. The trunk will normally include the protection and isolation equipment when leased facilities are used. A trunk is switch-connected at both ends.

Trunk Circuit - The circuitry being controlled by the VSCS to directly connect with another switching system.

Trunk Group - A number of trunks that can be used interchangeably between two or more switching systems.

Trunk Multi-Point - A dedicated trunk that is shared by three or more positions, at two or more facilities.

Turnkey - Complete single responsibility from start to the point of turning over the final system, ready for operational use.

Type - A particular kind, class, or group.

Type Test - Tests performed to verify that the equipment or system performs over the range of specified service conditions.

Unit - An assembly or any combination of parts, subassemblies, and assemblies mounted together, normally capable of independent operation in a variety of situations.

Utility Program - A computer program in general support of the processes, of computer, e.g., loading, sorting, trace routines, or copying data from one storage device to another.

Voice Call - A call mode wherein initial circuit connectivity is always to the loudspeaker at the called position. Prior to answering, the called party must switch the connection (single touch action) to his or her headset. Voice calling is an overlay mode, that is, it can be used in conjunction with direct access or indirect access modes. Also known as group alerting.

Voice Call Circuit - A special connectivity path for processing voice calls to selected loudspeakers.

VSCS Console Equipment - The complement of VSCS position equipment consisting of the VSCS position equipment consisting of the VSCS position electronics box, the indirect access keypad and interactive display unit(s) (panel(s)).

VSCS Interactive Display Panel - A physical device that provides display and control access to the user.

VSCS Numbering Plan - A uniform numbering system wherein all positions with VSCS display panels in an ARTCC/ACF have unique designations similar in form to those of all other ARTCCs/ACFs connected to the NAS Integrated Communication System.

VSCS Power Outage - The total loss of power to the VSCS of no more than 20 minutes.

WINKING - A visual signal interrupted 60 times per minute with a 95:5 on:off ratio.

Zip Tone - A 0.2 second burst of dial tone.

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TRAINING AND DEPOT SUPPORT REQUIREMENTS

1.0 OVERVIEW

The Voice Switching and Control System (VSCS) training shall be provided for personnel at the En Route Air Traffic Control Centers (ARTCCs), the Mike Monroney Aeronautical Center (FAAAC), and the FAA Technical Center (FAATC). Each operational site will use VCE Trainers (VCETs) to provide initial and refresher VSCS Console Equipment (VCE) training for Air Traffic (AT) controllers and supervisors. In addition, the VSCS equipment shall support AT training in the Dynamic Simulation (DYSIM) environment. The AT training for the operational site cadre will occur at the operational site. The Airway Facilities (AF) training will occur at the contractor's facility, Melbourne, FL, FAATC or FAAAC. The AT and AF training for Operational Testing & Evaluation/System Shakedown Testing (OT&E/SST) will occur at the contractor's facility, Melbourne, FL. The AT training, AF training, and Depot support shall occur on a non-interfering basis.

2.0 VSCS CONSOLE EQUIPMENT TRAINING

2.1 SCOPE

Each operational site shall be equipped with VCE Trainers (VCETs) to provide Journeyman and Phase VIII Developmental Air Traffic Controllers initial and proficiency training on the VCE prior to the Initial Operating Capability (IOC) date. Once the VSCS is operationally ready, the AT Controllers will receive refresher VCE training using the VCETs.

2.2 RESERVED

2.3 VCET FUNCTIONAL REQUIREMENTS

a. The VCET shall provide a stand-alone training environment. The training will not require voice audio or access to other VCETs.

b. The VCET shall incorporate actual VCE hardware and software, as required, to provide an interactive training capability of the AT Controller and the AT Supervisory VCE position equipment that is installed in the M-1 consoles on the operational floor of each ARTCC. The interactive training capability for the VCET shall include all visual and aural indications associated with the operational equipment, including incoming and outgoing air-to-ground (A/G) and ground-to-ground (G/G) calls.

c. The interactive capability shall present VSCS specific functional training in a programmed instruction (self-paced) format. This instruction shall be a planned sequence of small steps that will require active involvement and responses by AT Controllers and Supervisors. As a minimum, the characteristics of the programmed instruction shall provide immediate feedback to the Controllers and Supervisors, permit learner control of the equipment, provide for content and instructional adaptability, and present the multipurpose aspects of the VSCS.

2.4 VCET EQUIPMENT REQUIREMENTS

a. AT Control Specialist Positions shall incorporate actual VCE hardware in accordance with FAA-E-2731, paragraph 3.4.9, as required to provide an interactive training capability. AT Controller interfaces, software, documentation, and training materials shall also be provided.

b. AT Supervisor Positions shall incorporate actual VCE hardware and software in accordance with FAA-E-2731, paragraph 3.4.5, as required to provide an interactive training capability. AT Supervisor interfaces, documentation, and training materials shall be provided.

c. Both VCET position equipment shall be:

1. Stand-alone devices that do not provide voice audio.
2. Mounted on appropriate workstations.
3. Operate using existing power, air conditioning, and heating.

3.0 DYSIM TRAINING

3.1 SCOPE

Each operational site has a dynamic simulation (DYSIM) laboratory for developmental and refresher training of the AT Controllers. This laboratory uses M-1 consoles/Plan View Displays and the WECO communications equipment to simulate the operational scenarios from an operational AT control (ATC) position. The VSCS shall replace the WECO communications in the existing (M-1) DYSIM consoles and shall provide simulated A/G and G/G communications in both the (M-1) DYSIM consoles and Initial Suite Sector System (ISSS) common consoles.

3.2 M-1 DYSIM TRAINING

The DYSIM training in the M-1 consoles/Plan View Displays will use one half of the existing consoles for student positions and the other half for instructor/simulated remote controller/pilot positions. The VSCS shall provide simulated A/G and G/G communications capability.

4.0 AIRWAY FACILITIES TRAINING REQUIREMENTS

4.1 SCOPE

The FAA AF Training System shall provide the capability, as a minimum, to train VSCS NAS Managers, System Performance Specialists (SPSs), and AF Maintenance Technicians. AF training will include VSCS and VCET hardware and software maintenance and VSCS database management. The hardware instruction will include certification and training on VSCS hardware diagnostics, maintenance diagnostics demonstrations (at the maintenance position) plus removal and replacement of Line Replaceable Units (LRUs). The software instruction will include, at a minimum, software maintenance, system initialization (cold and warm starts), system reconfigurations, and database management.

4.2 AF FACILITY REQUIREMENTS

The Government-provided AF Training Facility at the Mike Monroney Aeronautical Center will consist of two identical laboratory classrooms and a VSCS Switching Equipment (VSE) room. The VSE room, which shall contain the VSCS switching equipment, maintenance console, and supervisor VCETs will be located adjacent to the two laboratory classrooms.

4.2.1 AF Laboratory Classrooms

a. Each laboratory classroom shall provide the capability to simultaneously train, on a non-interfering basis, 12 students supported by one instructor.

b. Each laboratory classroom shall be equipped with 13 VSCS Supervisory Positions, 13 Data Entry Positions, and 13 Workstation terminals for Software maintenance training.

c. The workstation terminals shall support software maintenance and development training.

d. The laboratory classroom equipment, located adjacent to the VSE room, shall be housed in the two 1000 square foot classrooms.

e. The laboratory classroom equipment shall be mounted on AF Student Workstations that shall provide:

1. 18" by 36" unobstructed work space.

2. An unobstructed view of the front of the laboratory classroom, e.g., the student will have a clear view of the instructor, chalkboard, etc.

3. A storage area (below the level of the workspace) for VSCS course and student reference materials.

4.2.2 VSCS Maintenance Position

a. The maintenance position shall be located in the equipment room.

b. The interactive display units shall be capable of driving a large screen display(s) readable from a distance of 10 feet.

c. Both the position and the large screen display(s) shall be situated to allow for VSCS maintenance diagnostic demonstrations and training.

4.2.3 AF VSCS Switching Equipment (VSE) Requirements

a. The VSE shall be installed in a 2000 square foot equipment room.
b. The VSE shall be equipped with:

1. 70 A/G ports (50 radio interface and 20 Backup Emergency Communications (BUEC) ports).
2. 160 Trunks.
3. 30 Voice Call Trunks.
4. 120 Positions.

4.3 AF EQUIPMENT FUNCTIONAL REQUIREMENTS

The VSCS for AF training shall provide the functionality of an operational site, including all VSCS A/G and G/G communications functions, e.g., confirmation of touch entry device selections and direct and indirect access functions. These functions shall be accomplished, wherever possible, in the absence of external communications equipment, e.g., Backup Emergency Communications (BUEC), radio interfaces and Trunks.

a. The 12 student and one instructor Supervisory positions shall be capable of simultaneous logon and shall be capable of providing all Supervisory functions.

b. The 12 student and one instructor VSCS data entry terminals shall be capable of simultaneous logon and shall be able to perform all data entry functions.

c. The 12 student and one instructor VSCS software workstation terminals plus the software support equipment shall support software overview training and software maintenance and development training that includes:

1. Software overview, introductory, and familiarization training in the AF VSCS laboratory classrooms for air traffic control facility users. This training will include software architecture, maintenance analysis, and error messages.

2. VSCS software maintenance and development. VSCS software support shall include, as a minimum: Application Software, Databases, and Developmental Support Software and Libraries associated with the VSCS, e.g., Utilities, Compiler/Assemblers, Linkers, and Debuggers.

4.4 AT FACILITY REQUIREMENTS

Classrooms provided at the sites for cadre training shall include equipment required to teach equipment familiarization and position operations in the classrooms.

4.4.1 AT Classrooms

Each AT classroom shall contain VSCS Equipment Trainers (VCETs) for computer-human interface familiarization training for both the Air Traffic Control Specialist (ATCS) and Supervisory Air Traffic Control Specialist (SATCS) courses. Additionally, for area supervisor/area manager training, each classroom shall be equipped with a personal computer (PC) and a liquid crystal display (LCD) data projector to display the images on the PC to a large screen suitable for viewing by all class participants. The contractor shall provide the PC and LCD data projector for each site to conduct the cadre training.

a. The PC equipment required for SATCS training shall include, at a minimum, the following:

1. A 486DX, 33 MHz processor
2. 8 MB of RAM
3. 125 MB of storage
4. A color VGA external monitor port
5. A mouse port

b. The Liquid Crystal Display (LCD) data projector shall have the following specifications:

1. 3 LCD panels with 1 lens
2. A light output of 350 lumens
3. Projection capability of 33.3 feet
4. Projected picture size of 28 to 200"
5. Auto focus capability
6. Remote control image adjuster

5.0 RESERVED

6.0 DEPOT FACILITY SUPPORT REQUIREMENTS

The FAAAC will provide Depot level maintenance and engineering support. To provide this support, the Depot will have VCE and a remote maintenance position located in the Depot Facility plus access to the VSCS in the Academy AF Training Facility.

6.1 REMOTE MAINTENANCE POSITION

The Depot Facility shall have a remote maintenance position that provides access to the VSCS maintenance functions.

6.1.2 VSCS Console Equipment

The Depot Facility VCE will be installed in six (6) ISSS common consoles that shall have full VSCS functionality.

6.1.3 Remote VSCS Console Equipment

The Depot VCE shall be capable of being located up to one mile from the AF VSCS system.

6.1.4 Special Maintenance Tools

The Depot Facility shall have Line Replaceable Units (LRUs) maintenance tools and test fixtures as required by the Depot Maintenance Analysis.

VOICE SWITCHING AND CONTROL SYSTEM

Attachment J-3

PRODUCT SPECIFICATION

Planned Product Improvements

FAA-E-2731G

Addendum 2

SCN-PSR-016 02 July 1998

5 January 1996

DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

This addendum provides the changes necessary to incorporate the Planned Product Improvements into the VSCS product specification. Where applicable, the paragraphs identified by this addendum and the paragraphs identified in Addendum 1, shall supersede the existing paragraphs of the VSCS product specification. When conflicts exist between the paragraphs of Addendum 1 and Addendum 2, the paragraphs of Addendum 2 shall take precedence.

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2.2.3 Other FAA Documents

Document	Title
NAS-IR-61004201	ACF-VSCS
NAS-IR-21014201 (Part 2)	VSCS-ACCC (Common Console) IRD
NAS-IR-64024201	VSCS-BUEC IRD
NAS-IR-42009404	VS-PABX IRD
NAS-IR-42014202	VSCS/TCS INTERPHONE IRD
NAS-IR-42004205	VS-REC IRD
NAS-IR-92020000	CTS/USER SYSTEMS IRD
NAS-IR-80104201	VSCS-Power IRD
VS-I-03	VSCS-Existing Radio Interfaces ICD
VS-I-01	VSCS-TRUNKS ICD
NAS-IR-44010002	TRANSMISSION EQUIPMENT: ANALOG INTERFACE IRD
FAA Order 1600.54	Security of FAA Automatic Data Processing Systems and Facilities
FSD/VSCS-WP-001.6	VSCS Distribution Frame and Radio Interface Intermediate Distribution Frame Top Level Design
FSD/VSCS-WP-004.1	VSCS Ground-to-Ground Top Level Design
CTA-211-V-0208-91	Interaction of the Dual Jack Modules
DCN-410-RPT-0930-92	Data Entry Operator (DEO) Position Operations Concept Report

3.1.4.4 VSCS Switching Features - Special features provided by the VSCS shall include, but not be limited to: local and remote override (OVR), hold, call forwarding, monitoring, headset (HS)/loudspeaker (LS) transfer, and three types of conferencing: progressive, meet-me, and preset conference.

3.1.5 Reconfiguration Functions

The VSCS shall provide the capability for reconfiguration of communications connectivity for each operating position. This shall include Direct Access (DA) assignments and indications, radio frequency assignments, and classmarks and functions commensurate with the responsibilities of each operating position. The position displays shall correspond to the new connectivities. VSCS reconfiguration of communications connectivities shall be performed by a two step process (See 3.5.4.1.2). Reconfigurations shall be executed in accordance with predetermined maps in response to reconfiguration commands. Execution of reconfiguration shall not, in any way, interrupt or disturb the calls in progress. The details are specified in 3.5, Switching and Control Functions.

3.1.6.1 Timing and Synchronization - The VSCS shall provide an interface to the coded time source for time stamping. This interface shall be in accordance with the CTS/User Systems IRD. It shall also have the capability to synchronize with external networks to support communications (See 3.5.4.4).

3.1.9.2 Fault Detection and Isolation - The VSCS shall provide fault detection and isolation including self-diagnostics and the capability to identify a failure; isolate the defective module, circuit, or trunk; automatically configure its function around the problem; and allow the isolated faulty module to be serviced without disrupting ATC operations. All detected faults shall be automatically reported to the maintenance and NAS Manager positions for testing and correction.

3.1.9.3 Testing - The VSCS shall have the capability to initiate automatic and manual test routines. The VSCS shall monitor the results of automatic test routines from the maintenance and NAS Manager positions for any system elements identified by the fault isolation mechanism. The VSCS shall minimize the need for specialized test equipment by built-in self-test features.

3.2.2.2.7.1 IC Call Placement Response Time - The response time for this event, whether it be a two-party IC call or an IC addition to a progressive or preset conference call, shall be from the instant that the address is generated at the position, to the instant that the called position is notified by appropriate VSCS internal signaling. For 95% of the event completions, this event response time shall not exceed 250 msec. For 99.9% of the event completions, this event response time shall not exceed 350 msec.

3.2.2.2.7.2 IC Call Acceptance Response Time - The response time for this event, whether it be a two-party IC call or an IC addition to a progressive or preset conference call, shall be from the instant that the called position accepts the IC call, to the instant that an indicator response (ringback tone stops) is activated at the calling position, and voice communications over the established path can begin. For 95% of the event completions, this event response time shall not exceed 200 msec. For 99.9% of the event completions, this event response time shall not exceed 300 msec.

3.2.2.2.9.1.1 Position-to-trunk IP Call Placement Response Time - The response time for this event exclusive of type 5 trunks, whether it be an individual position-to-trunk IP call or an IP addition to a progressive or preset conference call, shall be from the instant that the address is generated at the position, to the instant that any signaling is initiated at the trunk interface. For 95% of the event completions, this event response time shall not exceed 200 msec. For 99.9% of the event completions, this event response time shall not exceed 300 msec. For 95% of the event completions, this event response time for type 5 trunks shall not exceed 250 msec. For 99.9% of the event completions, this event response time for type 5 trunks shall not exceed 450 msec.

3.2.2.2.9.2.2 Trunk-to-position IP Call Acceptance Response Time - The response time for this event, whether it be an individual position-to-trunk IP call or an addition to a progressive or preset conference call, shall be from the instant that the IP acceptance message is confirmed at the trunk interface to the VSCS, to the instant the calling position is notified (by a call indicator response), and voice communication over the established path can begin. For 95% of the event completions, this event response time shall not exceed 200 msec. For 99.9% of the event completions, this event response time shall not exceed 300 msec.

3.3.1.1 General Requirements - Each air traffic controller operating position within a facility shall be provided the capability for assignment of A/G communications functions. Assignment of an A/G communications function at a given air traffic controller position shall be controlled by configuration maps as determined by site adaptation data. A/G communications functions shall include, but not be limited to, the following:

a. Selection and deselection of the position's assigned frequencies.

b. M/S transmitter selection for each assigned frequency.

c. M/S receiver selection for each assigned frequency.

d. Selection and deselection capabilities for cross-coupling frequencies.

e. Independent enabling/disabling of transmission for each selected frequency at an operational position.

f. Independent local muting of received voice for each selected frequency at an operational position, for frequencies assigned to split-mode operations by site adaptation data.

g. Remote muting of receivers for selected frequencies.

h. Transmitter/receiver remote site selection for designated frequencies that have radio outlets at more than one remote site.

i. Enabling and disabling of automatic transfer of A/G voice from HS to LS if the operator engages in G/G voice communications.

j. RESERVED.

k. Selection and assignment of BUEC.

l. Selection of UHF or VHF emergency frequencies, or both, for reception or transmission, or both.

m. PTT preemption capabilities for selected frequencies.

n. Manual selection of routing of incoming voice to HS or LS for each selected frequency at a position, for frequencies assigned to split-mode operations by site adaptation data.

o. PTT lockout when A/G transmission is attempted on a frequency that is in use by another position.

p. Visual indication on all assigned frequencies of the presence of squelch break on received voice or PTT confirmation on transmitted voice.

q. Confirmation of PTT, M/S selection, remote and local muting, and frequency selection.

r. Enabling and disabling of radio transfer of A/G voice from HS to LS.

Requirements for each of the above listed A/G communications functions are detailed in the following paragraphs.

3.3.1.1.1.2 Displayed Frequency Values - All frequency values shall be displayed with values in MHz and decimal fractions thereof, to three decimal places (e.g., 125.550, 217.300). All frequency indications shall have a decimal point separating the integer and fractional portions of the frequency value.

3.3.1.1.4 Selection Using Transceivers - The above requirements shall not preclude the use of tunable radio transceivers. For facilities with access to tunable transceivers, M/S transceiver selection shall be provided. Tuning shall be accomplished external to the VSCS. Frequency selection shall be as described in 3.3.1.1.1.

3.3.1.1.5 Cross-coupled Frequencies - The VSCS shall provide the capability to cross-couple any two frequencies which are not operating in selective mode. The capability shall be provided to cross-couple at least two sets of two frequencies at each position. Cross-coupling shall be the capability to transmit the received voice of one frequency of the set over the other frequency of the set without operator intervention. Cross-coupling shall be implemented under program control as determined by site adaptation data.

3.3.1.1.5.2 Cross-coupled Frequency Indication - The enabled or disabled cross-coupling status for assigned cross-coupled frequencies shall be continuously visible to the position operator for those frequencies selected for use by the position operator.

3.3.1.1.5.3 Cross-coupling Enabling/disabling Methods - The position operator shall be provided the capability to enable the receiver-to-transmitter path(s) for cross-coupling two designated frequencies. A receiver-to-transmitter path shall be enabled or disabled by the position operator, provided that both reception and transmission on the desired path are enabled. The capability shall be provided for the position operator to have neither, either, or both receiver-to-transmitter cross-coupled path(s) enabled at any given time.

3.3.1.1.5.4 PTT Preemption of Cross-coupling - Activation of PTT at an operational position affecting a cross-coupled transmitter shall cause preemption of any cross-coupled transmission that may be in progress using that transmitter. Cross-coupling shall be restored upon PTT release.

3.3.2.1.2.6.1 PTT for G/G DA - DA call activations that require PTT shall emulate either a latching or non-latching pushbutton. PTT activation shall be required to transmit voice on the circuit, and call release shall be effected as described in 3.3.2.2.2. For the time interval that the G/G PTT feature is enabled at a position with A/G communications enabled, PTT shall not cause transmission of voice on any frequencies selected at that position. Release of the G/G call shall not reenable the PTT feature for A/G communications.

3.3.2.1.2.6.2 PTT Carry Over - Once a PTT has been established for a G/G call, release of the G/G call without releasing PTT shall not cause voice transmission over A/G frequencies with transmitters enabled. Placing or answering a subsequent G/G call without releasing PTT from a previous G/G call shall cause voice transmission over the subsequent G/G call. Once a PTT has been established causing voice transmission over A/G frequencies, placing or answering a G/G call without releasing PTT shall cause voice transmission over the G/G call and termination of the A/G transmissions.

3.3.2.1.2.7 ATIS Monitoring - Capabilities for monitoring Automated Terminal Information Service (ATIS) recordings shall be provided to designated VSCS operational positions. Access to ATIS recordings shall be by DA, IA, or both. Position access to ATIS shall be designated by classmark in the position map(s) of the configuration database.

3.3.2.2.4.4 Common Answer (CA) Queue - An Incoming call (IA or DA) to an operational position that does not have a corresponding DA touch area for answering the call (where answering is required) shall be directed to the called position's CA queue; otherwise, the capability for answering the call shall be provided at the appropriate DA selector.

3.3.2.2.4.4.1 Caller Identification (ID) - For an incoming call to an operational position that does not have a corresponding DA touch area, the VSCS position designator of the call source shall be displayed on the G/G communications CA queue display area of the called position. Where call source information is not available, the line/trunk designator for that incoming call shall be displayed on the CA queue area. Caller IDs displayed in the CA queue area shall not be shifted from one displayed queue position to another as a result of any changes in the number of calls in the queue. The CA queue area shall be capable of displaying at least 12 alphanumeric characters in each queue position.

3.3.2.2.6.2 Disabling Call Forwarding - A position operator shall be provided the capability of disabling the call forwarding function at an operational position by using an IA code. Additionally, if no forwarding destination is designated within 10 seconds after enabling of the call forwarding function at an operational position, or if any other G/G function is selected, then the call forwarding function shall be disabled. Call forwarding discontinuance shall be controlled by the initiating position or by the supervisory or maintenance and NAS Manager positions classmarked for that capability.

3.3.2.2.8 Conference Calls - The VSCS shall provide the capability for any position operator to initiate and participate in conference calls, up to the limits given in 3.5.2.2.2.5, Conferencing. Three types of conference capabilities shall be provided: progressive conferencing, meet-me conferencing, and preset conferencing. Access to conferencing capabilities at an operational position shall be defined and limited by classmarks in the position map(s) for the position. IA and DA access to conference calls shall be provided. A visual indication of participation in a conference call shall be provided to each position operator while active in a conference. Additionally, IC conferees shall be provided an indication that an incoming call is a conference call prior to answering the call.

3.3.2.2.8.2 Meet-me Conferencing - The VSCS shall provide the capability for operational positions to participate in meet-me conferences by a single touch action or by entering an appropriate IA function code sequence, or both. A conference bridge, or equivalent, with the feature that any operational position, up to the conference limit of the VSCS, accessing the bridge becomes party to any conference on the bridge, shall be provided. When a meet-me conference is active, any non-participating position with a DA for the conference shall receive an appropriate circuit-in-use indicator.

3.3.2.2.8.3 Preset Conferences - The VSCS shall provide for the identification and inclusion of preset conferences in an operational position's configuration map(s). Conferees shall be identified within the position map(s). Position operators shall not have the capability of modifying the conferee list. Preset conferences shall be accessible for initiation by an authorized position operator by DA initiation. A preset conference shall provide ringdown access to the conferees. Each called party, up to the VSCS conference limit, shall be able to join the conference by answering the call.

3.3.2.2.8.6 Conference Features - For progressive conference calls, an indication shall be provided to the conference initiator when the conference limit is reached. For progressive and preset conference calls, the VSCS shall terminate the call attempt to any party that does not answer within a suitable timeout period. Audio ringback shall be provided to the originator of a progressive or preset conference and shall terminate when any one conferee answers the call. For any type conference, an indication shall be given to any position operator attempting a conference when no system conference resources are available.

3.3.2.2.11 IA Special Functions - For functions at an operational position for which it is not practical nor desirable to maintain continuous direct operator accessibility to the function, the VSCS shall provide IA entry sequences to effect the desired functions in accordance with the VSCS numbering plan. The use of IA special functions other than enable/disable position split functionality mode at an operational position shall not affect any A/G or G/G communications that may be in progress at the position.

3.3.3.2.1 Display Brightness for Inactive Position - When a position becomes inactive, Interactive Display Unit (IDU) display brightness shall dim to the lowest readable level relative to facility lighting levels. When a voice input device is plugged into a previously inactive position, the brightness level for each display shall return to the last brightness level selected for the display before the position became inactive.

3.4.8.1.3.5 Call Forwarding Limits for Reconfiguration - Call forwarding between positions shall remain intact (i.e., between the original logical positions) under a logical-to-physical (LTP) reconfiguration in which the logical source and/or the logical destination are moved physically. Additionally, call forwarding shall remain intact if the destination position is logically reconfigured. Reconfigurations which alter the source position's logical identity need not retain call forwarding.

3.4.8.1.3.6 Voice Monitoring Limits for Reconfiguration - Voice monitoring between positions shall remain intact (i.e., between the original logical positions) under a logical-to-physical (LTP) reconfiguration in which the logical source and/or the logical destination are moved physically. Additionally, voice monitoring shall remain intact if the monitored position is logically reconfigured. Reconfigurations which alter the monitoring position's logical identity need not retain voice monitoring.

3.5.2.1.1.5 Cross-coupling - The cross-coupling capability shall be defined and limited by classmark in the position map(s). The switching function shall recognize a request for enabling cross-coupling of the designated frequencies and shall provide connectivity from the radio interfaces designated for reception to the radio interfaces designated for transmission. Squelch break signaling from the radio interfaces that provide a squelch break signal, on the frequency designated for reception, shall cause the switching function to generate PTT signaling and provide the voice to the radio interfaces on the frequency designated for transmission. If the radio interfaces do not provide a squelch break signal, the VSCS shall recognize reception of voice signals as the squelch break and shall then generate the PTT function to the radio interfaces designated for transmission. The switching function shall recognize and implement a request for disabling cross-coupling of the designated frequencies. Cross-coupling shall not degrade signaling time or voice quality at any of the multiple positions assigned either of the cross-coupled frequencies.

3.5.2.1.1.8.4 Cross-coupling Preemption - While the switching function is generating PTT for cross-coupling and providing voice to the frequency designated for transmission, any operational position's activation of PTT for the interface shall preempt the cross-coupled transmission and shall establish the preemptor for voice transmission and PTT signaling. Upon PTT release by the preemptor, the cross-coupling capability shall be reestablished.

3.5.2.1.2.2 Frequency Selection - The switching function shall recognize a request for a frequency selection from an operational position that has the frequency assigned. The VSCS shall then enable the established voice and signaling communication paths to the radio interface, providing the operational configuration for the interface has not been assigned to BUEC, and shall enable the recognition of position requests for:

a. Enabling/disabling transmission.
b. Enabling/disabling reception of voice.
c. M/S selection.
d. Remote receiver muting control and local position muting.
e. PTT keying.
f. Cross-coupling.

The position requesting frequency selection shall be provided a frequency selection confirmation from the switching function that shall include the operational status of the M/S control for transmission and reception, remote receiver muting control, and cross-coupling.

3.5.2.1.3.2.3 Priority Indication - Upon determination of the BUEC priority module accessed, all positions with that frequency selected shall be provided with the priority module number, and the switching function shall be enabled for recognition of position requests for:

a. PTT keying.
b. BUEC deselection.

Cross-coupling associated with the frequency shall automatically be disabled.

3.5.2.2.1 Call Processing - The switching and control functions shall include, but not be limited to, the following program controlled capabilities:

a. Recognize a call request and provide dial tone if applicable.

b. Recognize calling source.

c. Recognize type of call requested (DA, IA, conference, etc.).

    1. Look up called number.
    2. Process dialed number.

d. Determine and select path to called source. Any call directed to a called source not currently available in a configuration map shall be redirected to an available called source, as determined in the configuration map.

e. Test path availability.

f. Test path continuity.

g. Verify absence of foreign potentials.

h. Signal called source.

i. Monitor status of call.

j. Provide applicable signaling information of status of call to calling and called parties.

1. Ring back.
2. Ringing.
3. Tones.

k. Take down path when there is a disconnect by appropriate party.

3.5.2.2.2.5.3 Preset Conference - The VSCS shall provide for automatically signaling designated positions including automatic dialing to establish a preset conference.

3.5.3.1.1.1 Supervisory Positions - The VSCS shall include supervisory positions. Supervisory positions shall have access to control that includes, but is not limited to, requesting reconfiguration, establishing training positions, modifying the on-line functional capabilities of positions, monitoring status, monitoring performance, and requesting special monitoring or playback functions.

3.5.3.2.1 Operations Status Monitoring - The capability shall be provided to monitor operational functions to include, at a minimum, monitoring the operational status of A/G and G/G of all assignments within a facility. The status of these conditions shall be available for display at maintenance, supervisory, and designated ancillary positions.

Table XIII. Classmarks

For an operational position:
A/G capabilities and displays Reconfiguration initiation authorization Data access authorization Alarm/alert reporting Access to operational reports
For A/G communication capabilities:
Selective/split operations Transmitter/receiver site selection Selective mode transmitter tracking Frequency cross-coupling BUEC access M/S transmitter selection M/S receiver selection Remote receiver muting PTT preemption
For G/G communications capabilities:
DA call override IA call override Conference call initiation Position voice monitoring Voice monitor - suspend on override Position voice monitor recording PTT for G/G communications Access to and from PABX and PSTN Latching/nonlatching type of call activation Voice monitor mix

3.5.4.1.1.1.4.2 Physical Console Assignment Mapping Modifications - The physical console assignment mapping may be modified on-line. The capability shall be provided to modify the physical console assignment through the VSCS data entry devices. The system shall permit modifications to the current physical console assignment in effect. Additionally, when an LTP reconfiguration is requested to reinstate the original physical console assignment mapping, the initiating position shall have the option to make modifications prior to executing the reconfiguration (e.g., to account for a VCE outage). Access to this capability shall be defined by classmark. The Area Manager may modify the physical console assignment for any logical console identifier. Area Supervisors may modify only those physical console assignments for logical console identifiers within their area(s) of responsibility. Modifications shall not be lost upon subsequent logical reconfigurations and shall remain in effect until altered by a subsequent LTP reconfiguration. However, no modifications shall alter the original (i.e., DEO-created) mapping stored in the configuration database. Only the installation of a new configuration database may alter the stored maps. In the case of a failure, the system shall recover to the physical console assignment mapping in effect prior to the failure. A modification to the physical console assignment mapping may modify the physical console assignment for any number of logical console identifiers, up to the facility maximum. Only modifying the physical console assignment for a single logical console shall be used to transfer an existing logical console to any unused (i.e., unmapped or spare) physical console, for example, in response to a console failure (i.e., a VSCS console failure or the failure of non-VSCS console equipment). The user shall be able to view the desired changes prior to executing the changes. Upon command by the initiator, the system shall download the appropriate position maps to the affected consoles, adjust the switch map in accordance with the requested modifications, and execute the reconfiguration. At the initiator's option, a two-step process shall be available. In this option, the first step shall download the necessary map data and the second step shall implement the changes to the VSCS configuration. Timing performance shall be in accordance with 3.2.2.4. The number of sequential modifications which may be made to the physical console assignment mapping shall be unlimited. Overlapping or simultaneous modification requests shall be handled in accordance with 3.5.4.1.2.5 and 3.5.4.1.3.1.

3.5.4.1.2 Reconfiguration Process - The VSCS shall perform reconfiguration as a command-driven two-step process. During step one, VSCS shall prepare the called for reconfiguration map(s) for implementation. In step two, VSCS shall, upon command, implement the configuration map(s) prepared in step one. The reconfiguration process shall provide the capabilities to perform a logical reconfiguration (i.e., facility-, area-, sector-, or position-level reconfiguration), a logical-to-physical reconfiguration, or a combination of a logical and a logical-to-physical reconfiguration. For example, it shall be possible to request a single reconfiguration which combines two sectors, rolls out a third sector (e.g., to add another position) and changes the physical console assignment for a non-sector ATC position.

3.5.4.1.2.1 Reconfiguration Execution Sequence - The source of reconfiguration commands will be an appropriately classmarked VSCS console. These consoles are referred to as "the controlling position." The controlling position will send a command to the VSCS to begin the reconfiguration sequence. The VSCS shall prepare the requested map(s) for implementation and shall advise the controlling position when the requested reconfiguration can be implemented. The controlling position shall send a command to the VSCS to implement the reconfiguration. The reconfiguration initiation and execution commands shall be manual inputs from the VSCS supervisor's console.

3.5.4.1.4 Monitor and Control - Upon receiving a reconfiguration initiation command, the reconfiguration operational sequence shall be controlled and monitored. The control function shall accept status and acknowledgments from the display and switching functions as to the progress of their respective reconfigurations. The display and switching functions shall acknowledge reconfiguration initiation. Immediately following initiation of the reconfiguration download stage, the VSCS shall determine the functional status of VCEs involved in the reconfiguration. If the functional status of any affected VCE(s) is failed or degraded, the reconfiguration download shall be halted and status feedback shall be provided to the initiator. The initiator shall be given the option to continue or cancel the reconfiguration download. Immediately following the initiation of the reconfiguration execution stage, but prior to implementation of the new configuration maps, VSCS shall verify that both system level and VCE resources to complete the reconfiguration are available and shall reserve resources to complete the reconfiguration and/or to permit cancellation of the reconfiguration (i.e., return to the previous operational configuration as defined in 3.5.4.1.6.2). If resources (e.g. system-level or VCE) are not available, the execution stage shall be automatically halted prior to the implementation of the new configuration maps, and the initiating position shall be provided an audible alert and description of the cause of the halted reconfiguration. In the event reconfiguration execution halts due to insufficient system-level resources, subsequent requests by the initiator to continue the reconfiguration execution shall be denied unless sufficient system-level resources have become available and can be reserved. In the event reconfiguration execution halts due to VCE outages, the initiating position shall be provided the option to continue the reconfiguration. Execution shall be in accordance with 3.2.2.4, Reconfiguration Timing Requirements, or shall follow completion of any calls in progress, at which time completion status shall be provided. The initiation and completion of each stage of the two-step reconfiguration process shall be reported to the initiator of the reconfiguration and to supervisors of areas affected by the reconfiguration. The completion of the preparation (i.e., download stage) of a two-step reconfiguration process shall also be audibly reported, however, only to the initiator. The capability shall be provided to the initiator and to the affected area supervisors to request a report of the current status of each reconfiguration in progress. This status shall include, as applicable, at least the following:

a. Reconfiguration initiated.
b. Sector positions or trunks being reconfigured.
c. Completion pending release of calls in progress.
d. Reconfiguration completed.
e. Fault or failure reports.
f. Resource violations; i.e., A/G connectivity (Table XI) or A/G fan-out (Table XII).

The capability shall be provided to the initiator of the reconfiguration and to the supervisors for reconfiguration within the area of their responsibility to initiate recovery procedures as defined in 3.5.4.1.6.2.

3.5.4.4.1 Time of Day - The VSCS shall provide a time-of-day reference that shall be capable of maintaining year, month, day, hour, minute, and second. The VSCS internal/external synchronization circuit shall permit synchronization within one (1) msec of an external time source. The VSCS shall provide for the manual entry of the time of day. The format shall be as described in the CTS/User Systems IRD (3.6.10).